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# Introduction

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**02 AIRCRAFT**
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **4105**

**03 AUXILIARY SYSTEMS**
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **4107**

**04 BIOSCIENCES**
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **4109**

**05 BIOTECHNOLOGY**
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. **4117**

**06 CHEMISTRY**
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **4120**

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Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **4141**

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Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics. **4146**

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Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. 4152

**10 ELECTRONICS**
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories. 4157

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Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. 4161

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Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. 4170

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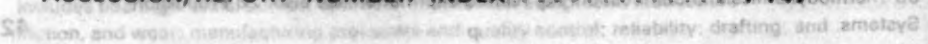
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Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space. Author

VOLUME 7 NUMBER 22 / NOVEMBER 23, 1969

# Scientific and Technical Aerospace Reports

*A Semimonthly Publication of the National Aeronautics and Space Administration*

## 01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery, wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

**N69-37521*#** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

**FORTRAN PROGRAM FOR CALCULATING TRANSONIC VELOCITIES ON A BLADE-TO-BLADE STREAM SURFACE OF A TURBOMACHINE**

Theodore Katsanis Washington Sep. 1969 99 p refs (NASA-TN-D-5427) Avail: CFSTI CSCL 01A

A method was developed to obtain a transonic flow solution on a blade-to-blade surface of a turbomachine. The blade may be fixed or rotating. The flow may be axial, radial, or mixed. The results include velocities on the blade surface and throughout the passage. The transonic solution is obtained by a velocity-gradient method, using information obtained from a finite-difference stream-function solution at a reduced weight flow. Author

**N69-37801#** Royal Aircraft Establishment, Farnborough (England). Structures Dept.

**CO-ORDINATED EXPERIMENTAL AND THEORETICAL RESEARCH ON THE OSCILLATORY AIR FORCES FOR SELECTED PLANFORMS AT SUBSONIC AND SUPERSONIC SPEEDS**

D. L. Woodcock Aeron. Res. Council 1969 117 p refs Supersedes RAE-TR-68033; ARC-30105 (ARC-R/M-3581; RAE-TR-68033; ARC-30105) Copyright. Avail: CFSTI

Oscillatory heave and pitch derivatives have been determined experimentally and theoretically for a set of eight planforms: three cropped delta wings, three arrowhead wings, and two unswept tapered wings. Three experimental procedures of widely different type were used. These were a free oscillation technique for a wall-mounted half-span wind-tunnel models. A similar technique for models mounted on rocket-boosted test vehicles and an inexorable forcing technique of the internal rigid drive type applied to half-span wind-tunnel model wings. The theoretical values were obtained by various forms of lifting-surface theory. All these results are tabulated and compared. They cover a Mach number range of approximately 0.8 to 2.5. Some theoretical values of control-surface derivatives are included in the tables, and a few other miscellaneous experimental or theoretical results are also described. Author (ESRO)

**N69-37939#** McDonnell-Douglas Co., Long Beach, Calif.

**ON THE REMARKABLE ACCURACY OF THE VORTEX LATTICE DISCRETIZATION IN THIN WING THEORY**

R. M. James Feb. 1969 92 p refs (DAC-67211) Avail: CFSTI

The vortex lattice discretization is applied to the principal problems in thin wing potential theory to determine the loading given a specified downwash distribution over the planform. The leading edge singularity is automatically generated and there is no need to introduce special (singular) loading functions. Loadings derived by this method always satisfy the Kutta condition at (subsonic) trailing edges; and the same location points for vortices and downwash sensing stations work irrespective of the order of the system. It is shown that an analytical inverse for the vortex lattice influence matrix exists in this case; that this discretization necessarily possesses all the features described; that choice of 1/4 and 3/4 points for the vortex and sensing stations is both optimal and mandatory; that an exact appraisal of the errors is available for all orders. Author

**N69-37940#** Bristol Univ. (England).

**NONLINEAR STRUCTURAL DYNAMICS PROBLEMS IN AERONAUTICS**

A. Simpson Aeron. Res. Council 1969 18 p refs Supersedes (ARC-CP-1048; ARC-30821) Copyright. Avail: CFSTI; HMSO: 4s 6d

This paper is concerned with the classification of nonlinear vibration problems which occur in the field of aeronautics—excluding those problems which may be more suitably defined under the heading 'nonlinear problems in control engineering'. It comprises a short catalogue of practical problems, methods of solution and relevant sources of references. Author (ESRO)

**N69-37941#** Aeronautical Research Council (Gt. Brit.)

**THE DRAG OF INFINITE SWEPT WINGS WITH AN ADDENDUM**

J. C. Cooke 1969 50 p refs Supersedes RAE-TN-AERO-2866; ARC-28302 (ARC-CP-1040; RAE-TN-AERO-2866; ARC-28302) Copyright. Avail: CFSTI; HMSO: 13s

The drag of an infinite swept wing is found in terms of the drag of a related unswept wing having the same relative position of transition. Results in incompressible flow are expressed in terms of a 'sweep factor'. Detailed calculations are made for wings of RAE 101 and 104 sections and the factor appears to have a reasonably universal character not very dependent on shape or Reynolds number if transition takes place early, but strongly dependent on thickness. Results are given as a series of curves and an empirical formula is given for the sweep factor in terms of thickness-chord ratio, angle of sweep and point of transition. A few results are given for compressible flow over an RAE 101 section at sweep angles of 0° and 45°; these show the effect of sweep in delaying the compressibility drag rise. Author (ESRO)

**N69-37973*#** Texas A&M Univ., College Station. Engineering Experiment Station.

**IMPROVEMENT OF PROPELLER STATIC THRUST ESTIMATION. Status Report, 1 Nov. 1968 – 31 Aug. 1969**

C. F. Kettleborough 31 Aug. 1969 11 p

(Grant NGR-44-001-011)

(NASA-CR-66836) Avail: CFSTI CSCL 01A

This report describes further feasibility studies of the means of measuring the aerodynamic loading on the blade. The use of miniature pressure transducers has been shown to be unsatisfactory in view of the sensitivity of the transducers to high g loadings parallel to the plane of the transducer diaphragm and high cost. An alternative has been investigated using small bore thin-walled stainless steel tube. Some preliminary studies are reported using the Biot–Savart Law to determine the induced velocities. Author

**N69-38065*#** National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

**FLIGHT-MEASURED AERODYNAMIC DRAG OF TWO LARGE EXTERNAL TANKS ATTACHED TO THE X-15-2 AIRPLANE AT MACH NUMBERS OF 1.6 TO 2.3**

David F. Fisher Washington Oct. 1969 15 p refs

(NASA-TM-X-1895) Avail: CFSTI CSCL 01A

Full-scale power-on flight lift and drag measurements were made on the X-15-2 airplane just before and just after two large external fuel tanks were ejected. By subtracting the drag of the airplane after tank ejection from the drag of the airplane before tank ejection, the incremental drag due to the tanks was determined. Analysis of the data showed that the percentage increase of incremental drag due to the tanks was almost equal to the percentage increase in cross-sectional area caused by the tanks. A buildup drag estimate based on free-stream conditions agreed well with the flight data; whereas, the wind-tunnel data, although they had the same general trend of tank drag coefficient with Mach number, were lower than both the estimate and the flight data. Author

**N69-38112#** Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

**SHORT-COWL FRONT-FAN TURBOJETS; FRICTION DRAG AND WALL-JET EFFECTS ON CYLINDRICAL AFTERBODIES**

J. E. Green Aeron. Res. Council 1969 61 p refs Supersedes RAE-TR-67144; ARC-29545

(ARC-CP-1049; RAE-TR-67144; ARC-29545) Copyright. Avail: CFSTI; HMSO: 7s 6d

An approximate analysis is given of a turbulent wall-jet beneath a stream moving at constant city. The results of this analysis are used to predict the drag of a cylindrical afterbody immersed in the jet from a front fan with short cowl at subsonic flight speeds. Graphs are presented which allow rapid evaluation of afterbody drag for a range of jet pressure ratios and nacelle geometries. Author (ESRO)

**N69-38114#** Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

**FLIGHT MEASUREMENTS OF THE LIFT, LONGITUDINAL TRIM AND DRAG OF THE FAIREY DELTA 2 AT MACH NUMBERS UP TO 1.65 AND COMPARISONS WITH WIND TUNNEL RESULTS**

R. Rose, C. S. Barnes, and A. A. Woodfield Aeron. Res. Council 1969 49 p refs Supersedes RAE-TR-67036; ARC-29542

(ARC-R/M-3577; RAE-TR-67036; ARC-29542) Copyright. Avail: CFSTI; HMSO: £1 1s 6d

Measurements have been made on the Fairey Delta 2 60° delta research aircraft, mainly at 40 000 ft; some tests were made at lower altitudes to study aeroelastic effects. The main points from the results are as follows. The trimmed lift-curve slope is independent of incidence, but the trim curves are non-linear for large elevator deflections. The relationship between the drag coefficient and the square of the lift coefficient is non-linear at subsonic speeds but linear at supersonic speeds. The effect of altitude on the trim and drag results is significant, apparently because of aileron rigged-up angle differences, and Reynolds number effects. Comparison of flight and tunnel results shows good agreement for the slope of the trim curve, but there are significant differences in elevator angle. These differences are consistant with those found in the trimmed lift data and can not be completely explained in terms of the different aileron rigged-up angles in flight and tunnel. The lift and pitching moment are probably affected by the known difference between the development of the wing vortex in flight and tunnel. Agreement between flight and tunnel values of the elevator pitching power, and trimmed and untrimmed lift-curve slopes is good although that for the pitching power may be fortuitous; that for elevator lifting power is fair. The increase in maneuver margin from subsonic to supersonic speed is smaller in flight. Author (ESRO)

**N69-38133#** National Physical Lab., Teddington (England). Aerodynamics Div.

**NUMERICAL APPRAISAL OF MULTHOPP'S LOW-FREQUENCY SUBSONIC LIFTING-SURFACE THEORY**

H. C. Garner 18 Oct. 1968 114 p refs

(AD-690270; ARC-30607; S/C-4228) Avail: CFSTI CSCL 1/3

A brief review of oscillatory theories reveals that some of these suffer from a defect that has been corrected in the algol programme now subject to critical examination. Its features in steady and low-frequency subsonic flow are outlined, and extensive tabulated results are presented for seventeen planforms. The accuracy and convergence of solutions are studied in relation to arbitrary parameters representing chordwise and spanwise collocation positions, spanwise integration points and the essential central rounding of sweptback wings. Rectangular and other wings with streamwise symmetry, untapered and tapered sweptback wings, slender and curved-tipped wings show progressively slower convergence, and they are examined in respect of overall forces, spanwise loading, local aerodynamic centres, central chordwise loading and oscillatory pitching derivatives. Some new general criteria are recommended for selecting the arbitrary parameters. Serious inaccuracy arising from the original defect is established, and hence the need to examine theories for general frequency. The residual errors in the Algol programme may stem from high or low aspect ratio demanding extra spanwise or chordwise terms, but the most elusive cause of collocation error in the standard solutions is found to be insufficient central rounding of highly sweptback wings. It is demonstrated, however, that the rounding itself often influences the aerodynamics as much as the standard collocation error and in the opposite sense, so that one correction is useless without the other. Appropriate results with both effects taken into account provide a few examples of improved comparisons with exact theory and experiment. Author (TAB)

**N69-38176#** Lockheed Missiles and Space Co., Palo Alto, Calif.

**EXPERIMENTAL INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF A SPHERE IN FREE FLIGHT TO APPROXIMATELY MACH 15**

A. P. Krasilschikov et al [1968] 4 p refs Transl. into ENGLISH from Izv. Akad. Nauk, Mekh. Zhid. i Gaza (USSR), no. 4, 1968 p 190–193

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Wind tunnel data are presented for multiple tests on a sphere in free flight at Mach numbers from 1.5 through 15.2 and Reynolds number from $1 \times 10^6$ through $20 \times 10^6$. Specific values were obtained for the drag coefficient, shock standoff, shock wave radius of curvature in the stagnation point region, and shock wave shape. Author

**N69-38230#** Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

**WIND TUNNEL INVESTIGATION OF JET INTERFERENCE FOR UNDERWING INSTALLATION OF HIGH BYPASS RATIO ENGINES**

D. J. Raney, A. G. Kurn, and J. A. Bagley Aeron. Res. Council 1969 49 p refs Supersedes RAE-TR-68049; ARC-30153 (ARC-CP-1044; RAE-TR-68049; ARC-30153) Copyright. Avail: CFSTI; HMSO: 11s 6d

Current design proposals for many swept-winged aircraft have large engines of high bypass ratio with short fan cowls on short pylons under the wing, with the annular fan nozzle close to the wing leading edge. With such an arrangement there may be significant changes in the wing pressure distribution induced by the jet flow, particularly that from the fan. In consequence, the normal methods of simulating the engine flow in a wind tunnel model, by using simple open ducts, and no representation of the jet thrust, might not be adequate. The tests reported here were planned as an initial investigation of jet interference for this type of configuration. Results show that for conventional locations of the nacelle on the wing, representation of the cruising jet thrust has only a small effect upon the wing pressure distribution and then only on the lower surface. Author (ESRO)

**N69-38440#** Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

**THE AIRBORNE PATH DURING TAKE-OFF FOR CONSTANT RATE-OF-PITCH MANOEUVRES**

D. H. Perry London HMSO 1969 36 p refs Supersedes RAE-TR-68071; ARC-30529 (ARC-CP-1042; RAE-TR-68071; ARC-30529) Copyright. Avail: CFSTI; HMSO 8s

A method of estimating the airborne path during take-off is proposed, based on the assumption that the aircraft is rotated at a constant rate of pitch from the moment of lift-off to the point at which it attains a steady climb path. The justification for this assumption is discussed. A simplified analysis, using small perturbation equations of motion, has been developed for initial project studies. Examples of the method applied to a slender wing transport aircraft, and a lightly loaded STOL aircraft are given, and the factors affecting the value of rate-of-pitch used are discussed. Author (ESRO)

# 02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

**N69-37249#** Pisa Univ. (Italy).

**RAPPORT BETWEEN AUTOMOBILE AND AIR TRAFFIC [RAPPORTI TRA TRAFFICO AUTOMOBILISTICO E TRANSPORTO AERO]**

Lucio Lazzarino 1967 7 p refs In ITALIAN Presented at 24th Conferena del Traffico della Circolazione, Stresa, 28 Sep. – 1 Oct. 1967 *Its* Ser. 24, No. 1198 Avail: CFSTI

A brief perspective view of the problems in the interrelationships between the air and surface traffic systems is presented with emphasis on the automobile traffic. The necessity of a simplified long term solution to achieve an efficient integrated system is considered basic to the general economic growth of an area in which an industrial economy is developing. Transl. by F.O.S.

**N69-37254*#** International Business Machines Corp., Cambridge, Mass.

**V/STOL INERTIAL NAVIGATION WITH RADAR UPDATE CAPABILITY**

Aug. 1969 141 p (Contract NAS12-610) (NASA-CR-86234; IBM-69-NC7-027) Avail: CFSTI CSCL 01C

Derived, programmed, and verified are the equations for the Gemini computer which was flown onboard an H-19 helicopter to test radar update of the onboard inertial navigation system. With the primary purpose being to demonstrate all weather landing capability, the radar update is necessary to remove the accrued errors of the onboard system prior to the terminal landing phase. The navigation equations accept accelerometer outputs from the Gemini IMU and compute the vehicle's position and velocity in an earth surface fixed frame. When commanded via telemetry, the computer accepts radar position measurements, filters the data to obtain estimates of position and velocity, and updates the onboard navigation quantities. The resulting flight test results attest to the validity of both the equations and the approach. Author

**N69-37258#** Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.

**EFFECTS OF VARIATIONS IN SYSTEM DATA RATES AND MEASUREMENT ACCURACIES ON PILOT PERFORMANCE IN THE HELICOPTER IFR FORMATION FLIGHT MODE Final Technical Report, Dec. 1967 – Apr. 1968**

Paul A. Anderson and Myrna L. Thivanen Washington, D.C. Joint Army-Navy Aircraft Instrumentation Res. Apr. 1969 174 p refs (Contract N00014-66-C-0362) (AD-688200; Rept-12543-FR3; JANAIR-680408) Avail: CFSTI CSCL 1/3

Since system data rate and accuracy requirements depend on the system's raw data filtering model and its display quickening sensitivity, these two additional parameters and their interactions with the data rate and accuracy parameters were also investigated. Systematic man-in-the-loop simulations were conducted to select ranges of individual parameter variation and to examine relationships between the parameters within the ranges selected. Pilot performance was evaluated for the various combinations of four data update rates, four levels of data accuracy, and three levels of display quickening sensitivity. One specific filtering model was found to be appropriate for the ranges of the other parameters selected during the preliminary phase of the study and was used throughout the formal parameter interaction experiment. Performance measures recorded during the simulations included indices of proficiency in maintaining an assigned formation position, indices of control-input/aircraft-response activity, frequency of collisions with other formation aircraft, and frequency of other control losses. Results showed: (1) that pilot performance degrades approximately linearly with the decrease in data accuracy; (2) that a data rate as low as 4 updates/second yields adequate performance in the helicopter formation flight mode simulated for this study, with no improvement in performance resulting from higher rates; (3) that the optimal quickening model and the data filtering model for a specific helicopter formation flight system is a function of that system's data rate and accuracy. Author (TAB)

**N69-37360#** National Aerospace Lab., Tokyo (Japan).

**SYSTEM STUDIES ON AUTOMATIC LONGITUDINAL STABILIZATION CONTROL SYSTEMS FOR STOL AIRCRAFT. PART 1: AUTOMATIC ATTITUDE CONTROL SYSTEMS**

Yuso Horikawa and Mikihiko Mori 1968 47 p refs In JAPANESE; ENGLISH summary (NAL-TR-170) Avail: CFSTI

This report describes the equations of gain characteristics of an adaptive type Automatic Stabilization Equipment (ASE), and a programmed control and a torque balanced type ASE as adequate attitude control systems for the STOL aircraft using the above gain

characteristics. Certainly these results are easy to apply to the establishment of purely self-adaptive control systems. As the results of analysis on pitch angle feedback type ASE and angle of attack feedback type ASE, it is found that the approximate equations of gain characteristics can be written as simple first order equations of the lift coefficient $C_L$, and the ratios of gain, that is, control zeros, $K_\theta/K_\delta$ and $K_\alpha/K_\alpha$ are each nearly constant. It is also shown that these characteristics can make the circuits of the ASE more simple; that is, a simple programmed control system as an ASE having adaptive control characteristics, and the simplest ASE, a torque balanced type ASE, in a limited flight velocity region. The torque balanced type ASE is originally a fixed gain type ASE in spite of having an adaptive property, and problems when the torque balanced type ASE is adopted are discussed. Finally, some examples of numerical analysis of some STOL aircraft are shown.
Author

**N69-37846#** Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
**AIRCRAFT PROPELLER VIBRATION MEASUREMENT SYSTEM Final Report**
Richard C. Dorshimer Sep. 1969 118 p
(Contract FA-67-NF-257)
(D5-69-5; NA-69-23)

A slip ringless propeller-mounted data system was designed, fabricated and tested for the measurement of propeller blade strain during flight and ground operation of an instrumented aircraft. This data system is self-powered through the rotary motion of the test propeller, employs a 16 channel constant bandwith frequency modulated (FM) multiplex and signals are capacitively coupled from the propeller to the aircraft. The FM multiplex consists of 17 channels of information including propeller rpm and 16 strain gage channels containing information from dc to 1 kHz. An environmentally protected strain gage installation was also a consideration of this program. The FM multiplex is split into four groups of signals with a frequency translation process in order to conserve bandwidth and/or recording time on an airborne tape recorder. Seven additional data channels are provided on board the aircraft for inclusion of parameters needed to define the aircraft operating conditions. The data system was demonstrated for a period of 50 hours on an engine test stand during which the demodulated signals were observed and additional data was obtained relative to the system stability.
Author

**N69-37912#** Naval Postgraduate School, Monterey, Calif.
**A NONVARY-$C^*$ CONTROL SCHEME FOR AIRCRAFT**
Edward R. Rang 4 Jan. 1969 27 p refs
(AD-689731; NPS-57RJ9061A) Avail: CFSTI CSCL 1/3

A sum of normal acceleration and pitch rate appears to be the best variable to use to control aircraft in the longitudinal axis. The $C^*$-Criterion specifies that the time response of this quantity called $C^*$ must fall in a prescribed envelope for all speeds and altitudes. It is equivalent to requiring the control system to hold the coefficients of a certain equation, which describes the aircraft's short-period motion, fixed. This is done by using feedbacks with variable gains. The gain-changing mechanism is found using gradient techniques. The system was shown to be practical by an analog simulation. It was found to be tolerant of instrument noise, elevator hysteresis, and other complications not accounted in the analytical derivations. The study strongly suggests a modification of the $C^*$-Criterion. It is proposed that the coefficients in the expression of the quantity $C^*$ should be representative of the aircraft's parameters rather than have the values currently in use.
Author (TAB)

**N69-37978*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**SPIN-TUNNEL INVESTIGATION OF A 1/30-SCALE MODEL OF A SUBSONIC ATTACK AIRPLANE**
Henry A. Lee Washington Aug. 1969 29 p ref
(NASA-TM-X-1788) Avail: CFSTI CSCL 01C

Spin and recovery characteristics of a single-engine swept-wing model were tested. Several combat loading conditions were tested for a range of center-of-gravity positions. The effects of external stores, assymetrical loading conditions, and dive brakes were determined as well as parachute size requirements for emergency spin recovery. The results indicate that erect spins can be obtained for all normal loading conditions. Satisfactory recoveries can be obtained by the optimum control technique, i.e. simultaneous movement of the rudder to full against the spin, the ailerons to full with the spin (stick left in a left spin), and the elevator to full up (stick back). With dive brakes open, the airplane may not spin. For the asymmetric loading, spins will be possible only when most of the weight of the external stores is on the outboard wing (right wing for a left spin), and recoveries by optimum control will be unsatisfactory. The airplane will spin inverted, but spins may be difficult to obtain. The optimum control technique for recovery from an inverted spin is to neutralize all controls and then move the rudder to oppose the yawing motion. A parachute 25 feet in diameter (laid out flat) with a drag coefficient of 0.48 (based on the laid-out-flat diameter) and a towline length of 27 feet will suffice for emergency spin recovery.
Author

**N69-38019#** Royal Aircraft Establishment, Farnborough (England).
**CIVIL AIRCRAFT AIRWORTHINESS DATA RECORDING PROGRAMME. SPECIAL EVENTS RELATING TO AIRSPEED CONTROL AND HANDLING (FEBRUARY 1966 TO DECEMBER 1967)**
G. E. King, ed. Aeronautical Res. Council 1969 43 p refs
Supersedes RAE-TR-68195; ARC-31068
(ARC-CP-1051; RAE-TR-68195; ARC-31068) Copyright, avail: CFSTI; HMSO: 11s 6d

A small number of jet aircraft in normal airline service are fitted with recorders which produce continuous trace records of airworthiness data for 14 parameters. Throughout the recording period the records have been searched for unusual occurrences, and each one has been studied to determine its nature and, where possible, its cause. This report describes a selection of events relating to airspeed control and handling which were found in records taken between February 1966 and December 1967.
Author (ESRO)

**N69-38104*#** National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
**VARIATION IN ENGINE NOISE FOR TWO LANDING-APPROACH CONFIGURATIONS OF A JET TRANSPORT AIRCRAFT**
Elmor J. Adkins, Norman J. McLeod, and Paul L. Lasagna Washington, D.C. Oct. 1969 15 p refs
(NASA-TM-X-1896) Avail: CFSTI CSCL 01C

A limited flight investigation was conducted to determine the effect of reduced flap deflections on power required and the resulting engine noise for a subsonic jet transport aircraft. Noise levels were measured during level flight at an altitude of 400 feet (122 meters) at approach speeds. Data were obtained during flybys with flap deflections of 50° and 36°. The maximum overall sound pressure level (OASPL) from flybys with 36° of flap deflection averaged 3 decibels (ref. 0.00002 newtons/meter$^2$) lower than for flybys with 50° of flap deflection. Buffet intensity was reduced by the use of lower-flap deflections.
Author

**N69-38134#** Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
**THE WEIGHT GUARANTEE AS IT AFFECTS THE DEVELOPMENT OF AERONAUTICAL SYSTEMS**
Michael T. Bello May 1969 25 p ref
(AD-689837; ASD-TR-69-3) Avail: CFSTI CSCL 1/3

The report is a result of continuous effort by mass properties engineers of the requirements branch to inform management personnel of the necessity for, and the importance of, being 'weight conscious'. The primary purpose is to provide an awareness of the

various implications of an effective weight guarantee. The report presents an assessment of the weight guarantee as it affects an overall system program in the development of a vehicle of balanced design. Brief discussions are presented concerning the guarantee's philosophy of purpose and overall program impact as conceived by mass properties engineering. Variations in the aerodynamic performance of a large cargo aircraft are presented to emphasize the impact of deviations from the weight guarantee. Author (TAB)

**N69-38148#** Aeronautical Research Council (Gt. Brit.)
**LOADS EXPERIENCED IN TURBULENCE BY A CENTRAL AFRICAN AIRWAYS VISCOUNT WITHOUT AND WITH CLOUD WARNING RADAR**
N. I. Bullen and Judy E. Aplin 1969 27 p refs Supersedes RAE-TR-68065; ARC-30708
(ARC-CP-1038; RAE-TR-68065; ARC-30708) Copyright. Avail: CFSTI; HMSO: 7s

Counting accelerometer records were obtained from a Central African Airways Viscount. After a year's recording, cloud warning radar was fitted to the aircraft and data for a further three years were obtained. A comparison is made between the loads experienced during the two periods and it is concluded that the carrying of radar has little effect on fatigue damage, but considerably reduces the frequency of high loads, at 1 g the reduction being by a factor of six. Author (ESRO)

**N69-38184*#** Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
**SURVEY AND PRELIMINARY EVALUATION OF BAROMETRIC ALTIMETRY TECHNIQUES Final Report**
Raymond B. Harlan 2 Oct. 1969 38 p refs
(Contract NAS12-2016; DSR Proj. 71191)
(NASA-CR-86242; RE-61) Avail: CFSTI CSCL 01D

This report summarizes a brief survey of the state-of-the-art of barometric altimetry with emphasis on the problems concerning vertical separation of aircraft. Research on landing aids is centered principally on automated radiation systems for use under low visibility conditions. Author

**N69-38212#** Kansas Univ., Lawrence. Center for Research.
**APPLICATION OF COMPUTER METHODS IN AIR CUSHION VEHICLE RESEARCH Interim Technical Report**
Theodore Brstanow Apr. 1969 83 p refs
(Contract Nonr-4201(00))
(AD-689554; TR-4) Avail: CFSTI CSCL 1/3

The report contains an outline of a proposed novel method of investigation of moving vehicles and the elements of its analysis. In the proposed method, computer drawn movies are produced and their value in developing and testing of air cushion vehicles is demonstrated. Author (TAB)

**N69-38250#** Federal Aviation Administration, Oklahoma City, Okla. National Flight Inspection Div.
**EVALUATION OF MDC/EAL STOL DEMONSTRATION Technical Report, Sep. 1968 - Jul. 1969**
Barney Bryant and Frank Parr May 1969 113 p
(AD-689106) Avail: CFSTI CSCL 1/2

Data were collected during a demonstration of the Breguet Stol transport aircraft in the New York City area. Analysis of data was directed to the terminal area maneuvering requirements. Turning radii for 80 knots ias with a 15 degree bank angle appeared correct for use as a minimum standard in the development of departure routes and holding patterns. The angle between successive route segments limits the minimum distance between the way-points used to establish the intercepted segment. Author (TAB)

**N69-38544*#** Techtran Corp., Glen Burnie, Md.
**METHOD FOR ESTIMATING THE NOISE OF A TURBOJET ACCORDING TO ITS THERMOPROPULSION MAGNITUDE**
R. Hoch et al Washington NASA Sep. 1969 30 p refs Transl. into ENGLISH from French Paper Presented at AGARD Propulsion and Energetics Panel Meeting, St. Louis, France
(Contract NASw-1695)
(NASA-TT-F-12440) Avail: CFSTI CSCL 01C

A method is proposed for estimating the maximum noise produced by a turbojet by use of simple monographic charts which are based on the total thermopropulsion magnitudes. These are generally published in descriptive notices, or in the handbook on installation and properties of the turbojet. Author

**N69-38868*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**RESULTS OF A FREE-FLIGHT TEST TO DETERMINE THE PERFORMANCE CHARACTERISTICS OF A TOWED, CONICAL DECELERATOR**
J. W. Usry Washington 1969 34 p refs Film supplement number L-1049 to this report is available on loan from Langley Research Center
(NASA-TM-X-1833) Avail: CFSTI CSCL 01C

An inflatable fabric decelerator was tested in free flight to determine its drag and stability characteristics. The inflated decelerator approximated an 80° cone with a 48-inch (121.9-cm) base and was towed behind a cone–cylinder–flare payload at a distance of 13.6 feet (4.15 m) from the payload base. The payload had a maximum flare diameter of 18.21 inches (46.25 cm). The decelerator was deployed at an altitude of 112 000 feet (34.14 km) and a velocity of 4560 ft/sec (1390 m/sec). Inflation occurred at a Mach number of 4.31 and a dynamic pressure of 130 lb/ft$^2$ (6224 N/m$^2$). The snatch force after deployment was not more than 500 pounds (2224 N); this low force indicated that the towline assembly design could be simplified for future flights by eliminating the two snubber lines and the nylon sleeve. The shock force due to inflation was 5600 pounds (24.9 kN). After inflation the force in the towline varied between 300 and 1600 pounds (1334 and 7117 N). The oscillatory motion of the decelerator had a high frequency, and the amplitude increased with time. The test was terminated about 1 second after inflation because of a failure at the attachment point of the towline to the decelerator. The results indicated that the decelerator system was unstable and not suitable for use as a supersonic decelerator with the payload used in this experiment under the conditions of the test. A drag coefficient of 0.75 at a Mach number of 4.2 was estimated from the mean value of the force in the towline prior to the failure. Author

# 03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

**N69-37303#** Lightning and Transients Research Inst., Minneapolis, Minn.
**DEFINITION AND CHARACTERISTICS OF A LARGE ARTIFICIAL LIGHTNING GENERATOR AND HOUSING**
M. M. Newman, J. D. Robb, Ta Chen, Robert Parker, and Leonard Licking Jul. 1968 93 p
(PB-183585; LT-479; SC-CR-68-3731) Avail: CFSTI CSCL 04A

Contents: Natural lightning-discharge mechanisms; Natural lightning discharge characteristics; Damage mechanisms; Artificial lightning facilities for duplication of natural lightning damage effects; Artificial lightning generators; Connections between impulse generators and load; Configuration and mechanical design considerations; Capacitor designs; Housing and outdoor operation;

Output waveshape control and special instrumentation; Reproduction of continuing currents and multiple discharges; Power and control systems requirements; Safety considerations. USGRDR

**N69-37613*#** Union Carbide Corp., Parma, Ohio. Consumer Products Div.
**SECONDARY ZINC-OXYGEN CELL FOR SPACECRAFT APPLICATIONS Quarterly Report, 23 Sep. - 23 Dec. 1967**
23 Dec. 1967 24 p refs
(Contract NAS5-10247)
(NASA-CR-105921; QR-6) Avail: CFSTI CSCL 10B

Cycling of zinc-oxygen unit cells operating at a discharge current density of 25 mA/cm$^2$ has been demonstrated. This represents discharge to the 25 percent depth based upon the theoretical capacity available from the actual amount of zinc present in the anode. As of this time, the cells have delivered 56, 108, and 56 cycles at 0°, 25°, and 40°C, respectively, on a 2-hour discharge/4-hour charge test regime. Polarization data indicate that cells whose construction has been modified for high rate discharge possess the capability of discharging at current densities up to 70 mA/cm$^2$ (70 percent zinc depth). Cycle life, however, is increasingly limited as the depth of zinc discharge increases by redistribution of the zinc anode mass resulting in the gradual movement of zinc with successive cycles from the top of the electrode to the bottom. Anode constructions are being explored in an effort to maximize cycle life and discharge depth. Author

**N69-37701*#** Tyco Labs., Inc., Waltham, Mass.
**ALUMINUM CHLORINE BATTERY Quarterly Report**
Jose Giner and Brian Burrows Oct. 1968 27 p refs
(Contract NAS12-688)
(NASA-CR-86238; QR-1) Avail: CFSTI CSCL 10C

Work has been carried out during the present period to obtain pure NaCl-KCl-$AlCl_3$ electrolytes and to do preliminary studies of both Al and $Cl_2$ electrodes. Different commercial aluminum chloride materials have been investigated. Using cyclic voltammograms it has been found that the major impurity in all these materials is $Fe^{3+}$. A treatment with highly dispersed Al powder has been partially successful in purifying this electrolyte. Investigation of the Al anode shows the feasibility of steady state current densities up to 50 ma/cm$^2$, both in cathodic and anodic directions. At higher current densities, transients are observed which can be interpreted as being due to passivation by formation of a layer of solid salt. Preliminary experiments on the $Cl_2$ electrode using porous graphite as substrate show that graphite is severely attacked by the melt. The attack caused considerable swelling, suggestive of interplanar attack. Presumably, $AlCl_3$ is responsible since graphite is stable in alkali-halidemelts. Author

**N69-37702*#** Tyco Labs., Inc., Waltham, Mass.
**ALUMINUM-CHLORINE BATTERY Quarterly Report, 28 Aug. - 27 Nov. 1968**
Jose Giner and Michael Turchan Mar. 1969 19 p refs
(Contract NAS12-688)
(NASA-CR-86239; QR-2) Avail: CFSTI CSCL 10C

The feasibility of the chlorine cathode in $AlCl_3$-NaCl-KCl eutectic electrolyte has been studied. Investigations on vitreous carbon electodes have shown that carbon is intrinsically active for chlorine reduction in $AlCl_3$-alkali chloride eutetics. A study of compatibility of carbon electrodes for chlorine in $AlCl_3$-eutectics has uncovered carbon samples which appear suited for the construction of porous chlorine cathodes. In addition, a method has been developed to obtain very pure $AlCl_3$. Author

**N69-37703*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**REVIEW OF LIQUID-METAL MAGNETOHYDRODYNAMIC ENERGY CONVERSION CYCLES**
Frederick H. Morse (Maryland Univ., College Park) Aug. 1969 53 p refs
(NASA-TM-X-63671; X-716-69-365) Avail: CFSTI CSCL 10A

Interest in liquid-metal magnetohydrodynamic (LM-MHD) power generation has developed because of its high power density, its ability to operate both ac and dc generators, and the possibility of operation at moderate temperatures. Recent efforts and advances in LM-MHD have made the evaluation of such systems for spacecraft power supply feasible. In this report all of the reported LM-MHD power generation cycles are described and their efficiencies compared. A brief summary of the evolution and status of the LM-MHD power generation systems and a listing of facilities engaged in LM-MHD is also included. Author

**N69-37827*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**DIFFUSION LENGTHS IN SILICON OBTAINED BY AN X-RAY METHOD**
John H. Lamneck, Jr. Washington Oct. 1969 9 p refs
(NASA-TM-X-1894) Avail: CFSTI CSCL 10B

The necessity for a rapid method of measuring diffusion lengths of silicon solar cells in radiation damage and subsequent annealing studies led to the development of a new procedure utilizing a standard X-ray machine. After the machine was calibrated with cells of known diffusion lengths, measurements on test cells could be made at the rate of one every 2 min with a standard deviation of less than 2 percent. Author

**N69-37830*#** Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.
**EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS. ACCEPTANCE TEST OF GENERAL ELECTRIC COMPANY 12 AMPERE-HOUR AUXILIARY ELECTRODE NICKEL-CADMIUM CELLS**
Donald E. Christy 15 Jul. 1969 29 p
(NASA Order W12-397)
(NASA-CR-105830; QE/C-69-553) Avail: CFSTI CSCL 10B

Tabulated and graphical results are presented for acceptance tests of 12 ampere-hour cadmium-nickel secondary spacecraft cells with auxilliary electrodes. Results are given for phenolphthalein leak, capacity, cell short, immersion seal, overcharge, and internal resistance tests. Author

**N69-37883*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EFFECT OF ELECTROTHERMAL INSTABILITIES ON BRAYTON- AND RANKINE-CYCLE MAGNETOHYDRODYNAMIC SPACE-POWER GENERATION SYSTEMS**
Allan R. Bishop and Lester D. Nichols Washington Oct. 1969 18 p refs
(NASA-TN-D-5461) Avail: CFSTI CSCL 10B

Plane wave electrothermal instabilities are included in the analysis of idealized Brayton- and Rankine-cycle magnetohydrodynamic generators. It is shown that the instabilities cause an increase in Joule heating and a reduction in output power. An increase in the magnetic field can compensate for the reduction in output power. Author

**N69-38033#** Sandia Corp., Albuquerque, N.Mex. Aerospace Radioisotope Power Information Center.
**SELECTED THERMOELECTRIC, THERMIONIC, AND ELECTRON-VOLTAIC ENERGY CONVERSION DEVICE CHARACTERISTICS**
H. J. Gerwin (comp.) May 1969 27 p refs Sponsored by AEC
(SC-ARPIC-1011) Avail: CFSTI

Information on thermoelectric, thermionic, and electron-voltaic energy conversion devices that are commercially available or are in the prototype stage of development is presented. Included are certain devices for use in space, terrestrial, and marine environments. Technical data, applications of devices, and general cost information are included. Author (NSA)

N69-38275*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.
**EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: EVALUATION OF STORAGE METHODS, OPEN CIRCUIT VERSUS CONTINUOUS TRICKLE CHARGE, SONOTONE 3.5 AMPERE-HOUR SEALED NICKEL-CADMIUM SECONDARY SPACECRAFT CELLS**
D. F. Christy 6 Feb. 1969 27 p
(NASA Order W-11252-B)
(NASA-CR-106003; QE/C-69-69) Avail: CFSTI CSCL 10C

Presented are the results of the evaluation of storage methods, open circuit versus continuous trickle charge, Sonotone 3.5 ampere-hour sealed nickel-cadmium secondary spacecraft cells following the second 1-year storage period. Author

N69-38321*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**OBSERVATIONS OF DEGRADED CdS SOLAR CELLS**
Larry R. Scudder, Michael P. Godlewski, and Thomas M. Klucher 1969 25 p refs
(NASA-TM-X-52668) Avail: CFSTI CSCL 10B

An experimental study of changes in the electrical characteristics and cell surface temperatures of CdS solar cells was performed. The experiments showed that cells maintained at 25° C and open circuit load degraded in shunt resistance and electrical output when exposed to air-mass-one illumination (100 mw/cm$^2$) for periods up to hundreds of hours. The cells also developed hot spots. Cells subjected to dark forward biases, with current flow of 0.5 to 1.0 ampere, degraded in a similar manner and developed hot spots in only a few minutes time. The nature of the degradation in both cases suggests the formation of localized shorting paths across the barrier. Recovery of cell performance was produced (1) by reverse biasing the cells in the dark, (2) by excision of hot spot regions of the cell, or (3) by storage of the cells in the dark. Author

N69-38322*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**FABRICATION OF CdS PRESSED POWDER SOLAR CELLS**
C. K. Swartz, R. L. Schalla, and G. A. Mazaris 22 Sep. 1969 15 p refs
(NASA-TM-X-52884) Avail: CFSTI CSCL 10B

An experimental study was made of CdS pressed powder solar cell fabrication parameters. Such parameters as pressing pressure, sintering temperature, surface etching, barrier application, heat treatment, and contacts were varied to determine the optimum conditions. The most favorable fabrication procedures for making up to 5 percent efficiency (AMO, 25° C) CdS pressed powder solar cells are described. Author

N69-38423*# Tyco Labs., Inc., Waltham, Mass.
**DEVELOPMENT OF UNIFORM AND PREDICTABLE BATTERY MATERIALS FOR NICKEL-CADMIUM AEROSPACE CELLS Quarterly Report, 8 Nov. 1968 – 7 Feb. 1969**
7 Feb. 1969 74 p
(Contract NAS5-11561)
(NASA-CR-106013; QR-3) Avail: CFSTI CSCL 10C

This report describes studies of the loose or dry sintering of INCO types 255 and 287 carbonyl nickel powder. The factors in the sintering process that are important in the preparation of uniform and reproducible plaques for nickel cadmium batteries are defined. The influence on uniformity and reproducibility of variations in physical characteristics inherent in these fragile filamentary powders from batch to batch are examined. Variations were deliberately introduced into the samples by blending the two types of powder. The blending process itself as a potential source of nonuniform plaque properties was studied, since blending of various powder batches is a standard commercial practice to meet a particular bulk density specification. Plaques were prepared by loose sintering in a graphite mold at a range of sintering times and sintering temperatures. The following physical measurements were made on the plaque: weight per unit area, thickness, porosity, BET surface area, pore size distribution, resistivity, and mechanical strength. Author

N69-38442*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
**NIMBUS-D SOLAR CONVERSION POWER SUPPLY SUBSYSTEM Quarterly Technical Report, 15 Mar. – 15 Jun. 1969**
5 Sep. 1969 223 p
(Contract NAS5-10470)
(NASA-CR-108009; AED-R-3472; QTR-8) Avail: CFSTI CSCL 10A

Reported is the manufacturing and qualification testing of a modified solar conversion power supply subsystem for use with the Nimbus-D meteorological satellite. The system consists of eight identical storage modules, one control module, and one solar array. Two solar cell platforms containing n-on-p silicon solar cells mounted on each side of the sun oriented platforms comprised the solar array. Post manufacturing electrical confidence tests on 10- and 6-cell solar modules were satisfactory. Data from control module, storage module, and solar array acceptance tests are included. G.G.

# 04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N69-37235# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Speech Communication.
**SPEECH TRANSMISSION LABORATORY Quarterly Progress and Status Report, Jan. – Mar. 1969**
15 Apr. 1969 101 p refs
(Grants NIH NB-04003-07; NIH HD-02111-04)
(STL-QPSR-1) Avail: CFSTI

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2. SPECTRUM ANALYSIS USING THE FAST FOURIER TRANSFORM (FFT) J. Liljencrants p 7 – 13 refs (See N69-37237 22-08)

3. A QUANTITATIVE MODEL OF VOWEL PRODUCTION AND THE DISTINCTIVE FEATURES OF SWEDISH VOWELS B. Lindblom and J. Sundberg p 14 – 32 refs (See N69-37238 22-04)

4. ARTICULATORY DIFFERENCES BETWEEN SPOKEN AND SUNG VOWELS IN SINGERS J. Sundberg p 33 – 46 refs (See N69-37239 22-04)

5. THE DEPENDENCE OF VIBROTACTILE THRESHOLD AND MAGNITUDE FUNCTIONS ON STIMULATION FREQUENCY AND SIGNAL LEVEL: A PERCEPTUAL AND NEURAL COMPARISON O. Franzen (Stockholm Univ.) p 47 – 58 refs (See N69-37240 22-04)

N69-37238# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Speech Communications.
**A QUANTITATIVE MODEL OF VOWEL PRODUCTION AND THE DISTINCTIVE FEATURES OF SWEDISH VOWELS**
B. Lindblom and J. Sundberg *In its* Speech Transmission Lab. 15 Apr. 1969 p 14 – 32 refs (See N69-37235 22-04)
Avail: CFSTI

A physiological model of the speech organs is described

which can be used to generate an acoustic waveform appropriate to vowel sounds. This model resembles an artificial mouth with a tongue, jaw, larynx, and lips. The possible articulatory and acoustic capabilities of the model are also reported. Specific investigations were made on the proper use of the device to produce Swedish vowels and to answer questions concerning the phonetic dimension of the language's vowel system. Finally, the problem of relating the phonetic dimensions to the abstract phonological properties attributed to Swedish vowel segments is briefly treated, in an attempt to account for their systematic behavior in the phonological pattern of the language. Author

**N69-37239#** Royal Inst. of Tech., Stockholm (Sweden). Dept. of Speech Communications.
**ARTICULATORY DIFFERENCES BETWEEN SPOKEN AND SUNG VOWELS IN SINGERS**
J. Sundberg *In its* Speech Transmission Lab. 15 Apr. 1969 p 33-46 refs (See N69-37235 22-04)
Avail: CFSTI

Articulatory differences previously observed in the formant frequencies of vowels were investigated. Articulatory positions in spoken and sung vowels were analyzed by means of X-rays and lip photography. The acoustical implications of these differences were determined by means of an electrical-line-analog simulation technique. Author

**N69-37240#** Royal Inst. of Tech., Stockholm (Sweden). Dept. of Speech Communications.
**THE DEPENDENCE OF VIBROTACTILE THRESHOLD AND MAGNITUDE FUNCTIONS ON STIMULATION FREQUENCY AND SIGNAL LEVEL: A PERCEPTUAL AND NEURAL COMPARISON**
O. Franzen (Stockholm Univ.) *In its* Speech Transmission Lab. 15 Apr. 1969 p 47-58 refs (See N69-37235 22-04)
Avail: CFSTI

In order to obtain further knowledge concerning the neural mechanisms underlying sensory experience, an investigation was conducted to quantitatively characterize the relation between signal intensity and apparent intensity for various stimulation frequencies. Power transformation was of primary interest, and attempts were made to correlate the results with findings made in single-unit peripheral and central neurophysiology in the monkey and cat. The subjective detection threshold, as a function of stimulation frequency, is compared with the neural displacement-frequency curve for sinewave stimuli applied to the monkey foot. A dual mechanism of mechanoreception is discussed. A.C.R.

**N69-37270#** George Washington Univ., Alexandria, Va. Human Resources Research Office.
**THE EFFECTS OF SLEEP DEPRIVATION ON PERFORMANCE OVER A 48-HOUR PERIOD**
Eugene H. Drucker, L. Dennis Cannon, and J. Roger Ware May 1969 36 p refs
(Contract DAHC19-69-C-0018)
(AD-688950; HUMRRO-TR-69-8) Avail: CFSTI CSCL 5/10

An experiment was conducted to determine, for extended periods of work, the effects of (a) working for 48 hours without sleep on the efficiency of the work done, (b) starting work periods at night compared with starting in the morning, and (c) rotating jobs. Two-man teams performed a driving task and a target detection task; a control group performed the same tasks, but with provisions for sleep. Results indicate that performance deteriorates over a 48-hour period of work without sleep, and that deterioration occurs primarily at night, or during the subjects' normal sleeping hours. Job rotation to introduce another activity did not prevent performance decrements. Author (TAB)

**N69-37280#** Royal Aircraft Establishment, Farnborough (England).
**THE BEHAVIOUR OF THE NYSTAGMIC RESPONSE TO THERMAL STIMULATIONS AS A FUNCTION OF REPETITION OF THE STIMULUS AT SHORT TIME INTERVALS [IL COMPORTAMENTO DELLA RISPOSTA NISTAGMICA DA STIMOLAZIONE TERMICA IN FUNZIONE DELLA RIPETIZIONE DELLO STIMOLO A BREVI INTERVALLI DI TEMPO]**
V. Cenacchi et al May 1969 13 p refs Transl. into ENGLISH from Boll. Soc. Ital. Biol. Sper. (Italy), v. 41, 1965 p 531-535
(RAE-LIB-TRANS-1350) Avail: CFSTI

Described is the effect of repeated monoaural caloric irrigation in a group of 20 normal subjects. Each subject received a series of 10 irrigations with water at 30°C at intervals of 15 minutes, and nystagmus was recorded using an electro-oculographic technique. The nystagmic response showed a progressive attenuation with repetition of the test. Author

**N69-37308#** Systems Research Labs., Inc., San Antonio, Tex.
**PHYSIOLOGIC MECHANISMS PRODUCING DISORIENTATION Final Report, Jun. 1967-Feb. 1968**
John Fletcher Brooks AFB, Tex. AF School of Aerospace Med. Dec. 1968 34 p refs
(Contract AF 41(609)-2897)
(AD-689161; SAM-TR-68-132) Avail: CFSTI CSCL 6/19

Disorientation is a complex phenomenon involving changed perception of posture, direction, distance, spatial arrangements, or time. A short review is given of current knowledge about the occurrence of spatial disorientation in man and its relationship to performance. Consideration is given to certain unexplained changes in sensation produced during motion, including travel in space vehicles, aircraft, ground vehicles, and movements which occur in the course of everyday life. Author (TAB)

**N69-37316#** Cornell Univ., Ithaca, N.Y.
**ON THE SHARPENING MECHANISM OF THE HEARING SYSTEM**
A. Molchanov and C. Tappert *In its* Cognitive Systems Res. Program. Collected Tech. Papers, vol. 3 30 Jun. 1968 p 1-8 refs (See N69-37315 20-05)
Avail: CFSTI

The present paper describes a series of experiments on a peak detecting neural sharpening mechanism based on the hypothesis of double-differentiation in the place domain to improve a given system's ability in separating two sinusoidal signals of different frequencies. This sharpening mechanism makes use of neural inhibitory interaction similar to that found in the eye of the Limulus. To evaluate the possible improvement in performance of a given system in separating the two sinusoidal signals a comparison was made between the ratio of the amplitudes of the two signals at the input and the output of the system. The ratio at the input of the system can be calculated quite easily. However, the ratio at the output of the system, that is the relative increase in the output voltage due to the application of the second signal, can be quite difficult to estimate depending on the type of envelope detection employed. It is also evident that the performance of the system depends greatly on the property of the signal which excites the nerve endings. Author

**N69-37317#** Cornell Univ., Ithaca, N.Y.
**A HEURISTIC MODEL OF THE HUMAN VISUAL PERCEPTION SYSTEM**
Stephen Jon King *In its* Cognitive Systems Res. Program. Collected Tech. Papers, vol. 3 30 Jun. 1968 p 9-31 refs (See N69-37315 22-05)
Avail: CFSTI

The human visual processor or perception system is described in five black boxes with an interconnection scheme in a heuristic model based on available psychological and physiological data. The blocks are the preprocessor (which includes the eye), the figure and ground organizer, the recognizer, the encyclopedia, and the executive. The model applies to monocular perception of still, black

and white photographs; by these restrictions the model considers accomplished pattern recognition of a scene by basic perceptual analysis. Scene analysis of a photograph and a print of a fresco is demonstrated by the use of a flow chart. Optimum use of the research results of other workers in the field of artificial intelligence is made.
M.H.E.

**N69-37322#** Cornell Univ., Ithaca, N.Y.
**ACTIVITY REGULATION IN PERCEPTRONS**
Neil Mark Branston *In its* Cognitive Systems Res. Program. Collected Tech. Papers, vol. 3 30 Jun. 1968 p 79–138 refs
(See N69-37315 22-05)
Avail: CFSTI

In the following work the problem of the regulation of activity level in the model for brain function known as the "perceptron" is surveyed. Section 2 is given over to an introductory review of the perceptron and current philosophies of brain modeling. In Section 3 requirements and models of activity regulation devices are discussed, and in the next two Sections details are given of the mathematical analysis and computer simulation experiments carried out in order to investigate, demonstrate and compare the regulating and stabilizing effects of certain of these models as auxiliaries to selected perceptrons. Finally in Section 6 the results obtained and some suggestions regarding future work in this direction are discussed.
Author

**N69-37425#** Institute for Perception RVO-TNO, Soesterberg (Netherlands).
**INFLUENCE OF DIRECTION OF MOVEMENT AND PERIOD DURATION ON THRESHOLD SENSITIVITY FOR PERIODICAL HORIZONTAL MOVEMENT [DE INVLOED VAN BEWEGINGSRICHTING EN PERIODEDUUR OP DE DREMPELGEVOELIGHEID VOOR PERIODIEKE HORIZONTALE BEWEGING]**
J. P. vanBraam Houckgeest [1969] 21 p refs In DUTCH; ENGLISH summary
(IZF-1969-9; TDCK-53363-2) Avail: CFSTI

The parallel-swing experiments here reported have yielded data on the influence of the swinging period T upon the threshold for horizontal linear acceleration, and on the magnitude of threshold sensitivity for three directions of movement in the horizontal plane. A new method of threshold determination in this kind of experiment was used. It was found that for a subject lying on his back the threshold in the interval T=2 to 5 sec increases linearly (but not proportionally) with T; further, that threshold is minimal for transverse movement. Also, an impression was obtained of the importance of the vestibular system relative to the other sensory systems involved in the perception of the movement. It was concluded that under the circumstances of the experiment otolith information was more important than stimulation of the other systems involved. In the case of unusual head positions, however, an extra effect seems to be present tending to increase threshold, the influence of which is of the same order of magnitude as that which emanates from the otolith organs. Furthermore, a critique is given of the usual methods of threshold measurement on the parallel swing; experience with two other methods, which proved unsuccessful, stresses the importance of some of the objections raised.
Author

**N69-37469#** Institute for Perception RVO-TNO, Soesterberg (Netherlands).
**STANDARDIZATION OF THE DETERMINATION OF THE VISUAL ACUITY WITH OPTO-TYPE-CHARTS [STANDAARDISERING VAN DE GEZICHTSSCHERPTEBEPALING MET OPTOTYPENKAARTEN]**
J. J. Vos [1969] 34 p refs In DUTCH; ENGLISH summary
(IZF-1968-11; TDCK-53816-2) Avail: CFSTI

The current practice of the determination of visual acuity is defectively standardized. This gives difficulties at medical examinations and with the transfer of clinical data. It is investigated why the numerous efforts for standardisation have failed in the past. It seems that this is caused by a bad elaboration of the thoughts developed and by a complete absence of a follow-up to carry through the results obtained. Much care is bestowed upon concrete elaboration of the basic ideas of standardisation and upon the policy required to get the standard introduced and accepted.
Author

**N69-37587*#** Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
**STUDIES OF HUMAN DYNAMIC SPACE ORIENTATION USING TECHNIQUES OF CONTROL THEORY Status Report, Jul. 1968–Jun. 1969**
L. R. Young and Y. T. Li Jun. 1969 56 p refs
(Grant NsG-22-009-025)
(NASA-CR-105925) Avail: CFSTI CSCL 06P

Research over a wide range of topics related to dynamic space orientation and instrumentation of interest to aviation medicine was conducted. Areas investigated are: (1) manual control modeling of the human operator in a pilot role, particularly in complex multi-loop adaptive systems; (2) display systems for current and future vehicles emphasizing essential features which enable a pilot to sense his orientation with respect to earth and to other obstacles in the environment; (3) vestibular functions and responses to environment; (4) eye movement analysis and modeling; (5) cybernetic problems of manual control, human behavior, and man-machine systems; (6) neuromuscular and postural control; and (6) life support systems in unusual environments. Finally, possible applications of the research results to clinical medicine are discussed. These include use of hybrid computer displays for orthopedic surgeons, postural control diagnostics for neurology, diagnosis of diabetes mellitus from the system theory point of view; and use of new vestibular testing procedures to diagnose vestibular disorders.
A.C.R.

**N69-37757#** Aerospace Medical Div., Aeromedical Research Lab. (6571ST), Holloman AFB, N.Mex.
**A PRELIMINARY INVESTIGATION OF THE EFFECT OF REPEATED LOW DOSES OF MONOMETHYLHYDRAZINE ON OPERANT BEHAVIOR OF PRIMATES**
Gleyde D. Whitney, Henry L. Taylor, Duane R. Johnson, and Paul Y. Batson Mar. 1969 20 p refs
(AD-688253; ARL-TR-69-7) Avail: CFSTI CSCL 6/20

The rocket fuel monomethylhydrazine (MMH) is known to have severe disruptive effects on learned behavior. Behavioral toxicity, measured as decrement in instrumental performance, has been found following dosages of 2.5 mg/kg or more. This experiment was designed to explore effects on behavior of doses lower than those previously studied, and to investigate possible cumulative behavioral effects or repeated exposures to low concentrations of MMH. Monkeys performing a learned instrumental avoidance task requiring continual discrimination of cues were given repeated injections of MMH at four dose levels ranging from 0.5 mg/kg to 4.0 mg/kg. The results indicate that exposure to low doses may result in highly significant behavioral stimulation. Indications of a cumulative effect from repeated exposure on behavior are noted. Cumulative effects and increases in rate of performance following exposure to these doses may indicate important behavioral toxicity of MMH at dose levels lower than those previously considered.
Author (TAB)

**N69-37758#** Georgia Inst. of Tech., Atlanta. Electronics Div.
**PRELIMINARY INVESTIGATION OF THE USE OF ELECTROMAGNETIC RADIATION IN DIFFERENTIAL HYPOTHERMIA**
H. Allen Ecker, R. P. Zimmer, and R. W. Camp Jul. 1969 19 p refs
(TN-1) Avail: CFSTI

The objective was to investigate and to evaluate techniques

and practicable equipment suitable for accomplishing differential hypothermia (tumor-body) with electromagnetic energy. In general, it is desirable to produce a temperature difference of about 33°C between the tumor and surrounding tissue with the temperature of the tumor being maintained at normal body temperature and the surrounding tissue at the cooler temperature. During the initial studies, it was assumed that the subject tumor would be located deep below the surface of the body and investigations were concerned with that type of tumor. However, the heating of large surface tumors was emphasized later because it was believed that there was an immediate need for equipment to heat such tumors and that equipment suitable for treating these tumors could be designed with less effort than that required for a deep tumor. A survey of literature was made to obtain information on the electrical and thermal properties of biological materials and to determine existing theoretical and experimental techniques in the general area of microwave heating: the bibliography and more relevant references are included. Author

**N69-37842*#** Indiana Univ., Bloomington. Dept. of Botany.
**STUDY OF EFFECTS OF LUNAR MATERIALS ON BOTANICAL SYSTEMS (APOLLO 11) Final Report, 3 Feb.–30 Sep. 1969**
Paul G. Mahlberg 30 Sep. 1969 19 p refs
(Contract NAS9-9211)
(NASA-CR-101912) Avail: CFSTI CSCL 06C

The Botanical Test Systems are analyzed for their normality following test conditions with lunar soil. Four categories of tissues were selected for histological examination and evaluation. These are: callus tissues, cotyledon segments, leaf disks, and root segments. Experimental procedures are described, and results tabulated. F.O.S.

**N69-37878#** Reactor Centrum Nederland, Petten.
**THE DETERMINATION OF BROMINE IN WHEAT, FLOUR AND BREAD BY NEUTRON ACTIVATION ANALYSIS**
H. A. Das Apr. 1969 13 p refs
(RCN-106) Avail: CFSTI

A routine method is presented for the determination of bromine in wheat and bread by thermal neutron activation analysis. The application to the determination of traces of bromine-containing germicides is discussed. Author (ESRO)

**N69-37887*#** National Aeronautics and Space Administration, Washington, D.C.
**AEROSPACE MEDICINE AND BIOLOGY Continuing Bibliography with Indexes, Aug. 1969**
Sep. 1969 79 p refs
(NASA-SP-7011(67)) Avail: CFSTI CSCL 06C

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

**N69-37899#** Tennessee Univ., Knoxville. Dept. of Psychology.
**LONG-TERM EFFECTS OF RADIATION: MAMMALIAN BEHAVIOR Technical Progress Report, Feb. 1968 – Feb. 1969**
Ernest Furchtgott 28 Feb. 1969 12 p refs
(Contract AT(40-1)-3260)
(ORO-3260-4) Avail: CFSTI

This study proposes to measure longitudinally general activity in a small box with an ultrasonic device as well as in an open field and swimming speed in mice irradiated as young adults and who have passed the acute radiation syndrome. Both general activity and swimming speed decline with age. Thus, if radiation hastens and/or mimics normal aging, the irradiated mice should show the behavioral decrements sooner and/or to a greater extent than control animals. The behavioral measures will be correlated with general pathological indices. Author (NSA)

**N69-37909*#** National Aeronautics and Space Administration, Washington, D.C.
**AEROSPACE MEDICINE AND BIOLOGY Continuing Bibliography with Indexes, Jul. 1969**
Aug. 1969 172 p refs
(NASA-SP-7011(66)) Avail: CFSTI CSCL 06C

The contents of this issue are comprised of abstracts relating to biological, physiological, psychological, and environmental effects to which man is exposed during and following simulated or actual flight in the earth's atmosphere or interplanetary space. Included are such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors. References describing similar effects on lower biological organisms are also considered. G.G.

**N69-37917#** California Univ., Livermore. Lawrence Radiation Lab. Bio-Medical Div.
**RADIATION EFFECTS ON Poly-dAT FROM INTRAMOLECULAR TRITIUM**
J. A. Mazrimas, F. T. Hatch, C. C. Bishop, and J. E. Gill 6 Dec. 1968 30 p refs Sponsored by AEC
(UCRL-50559) Avail: CFSTI

Poly-dAT (a polymer of alternating deoxyadenylic and deoxythymidylic residues) was biosynthesized from tritiated deoxythymidine-5′-triphosphate of high specific activity and deoxyadenosine-5′-triphosphate. Aqueous solutions were stored at −20°C and thawed at intevals for comparison of template activity, ultraviolet absorbance and thermal transition with that of unlabeled poly-dAT. The $^{3}H$ content of the two samples was $1.5 \times 10^{8}$ and $4.4 \times 10^{8}$ dpm/mg. Radiation doses were estimated to be 2.9 and 8.6 rad/day (300 and 1000 rad over 3 months), respectively, assuming uniform distribution of absorbed energy in the solution. The normally excellent template activity of poly-dAT for RNA and DNA polymerases from *Escherichia coli* progressively decreased. The impairment became measurable after a dose of only 20-50 rad. After three months there was a moderate increase in molar ultraviolet absorbance at 260 nm and a marked increase in the absorbance ratios at 230/260 and 290/260 nm. Author (NSA)

**N69-37951#** Sandia Corp., Albuquerque, N. Mex.
**GENERALIZED SNAP SAFETY ANALYSIS MODELS**
R. E. Smith and I. J. Hall Sep. 1968 37 p refs
(Contract AT(29-1)-789)
(SC-DR-68-345) Avail: CFSTI

This report presents a general mathematical approach for evaluating the risk of using radioactive materials in space missions. Two basic safety models, that encompass the general safety criteria philosophies concerning the number of people receiving a specified amount of radiation and the total radiation received by the population, are derived. Each model is applicable to presently conceived hazard situations that may arise from the use of radioactive materials. Author (NSA)

**N69-38119#** Edgerton, Germeshausen and Grier, Inc., Los Angeles, Calif.
**HELIUM NEON LASER EFFECTS ON THE EYE Annual Report, 1 Aug. 1968 – 31 Mar. 1969**
Thomas P. Davis and William J. Mautner Apr. 1969 64 p refs
(Contract DADA17-69-C-9013)
(AD-689483; EG-G-C106-59223) Avail: CFSTI CSCL 6/5

The objective of this program was an investigation of the effects of helium-neon laser radiation on the eye. All exposures were of .10 second duration, and the ophthalmoscopically visible

retinal lesion was selected as the injury criterion. Median effective powers were established for retinal exposure spot diameters of 100, 260, and 800 micrometers. Injury was assessed immediately, and at 10 minutes, 1 hour, and 1 day post-exposure. An analytical prediction of the relationship between median effective power and spot size was also tested. The sensitivity ratio was not constant, but depended on spot size. Median effective powers increased with increasing spot size, as expected, but the increase was not as great as that predicted analytically. It was concluded that a thorough study of the analytical prediction of injury is needed to resolve this discrepancy. The need for a damage criterion based on functional injury was also recognized. Author (TAB)

**N69-38132#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

**SPACE CARDIOLOGY**

V. V. Parin et al Feb. 1969 258 p refs Transl. into ENGLISH of the publ. "Kosmicheskaya Kardiologiya" Leningrad, Izd. Meditsina, 1967 p 1-206

(AD-689027; FTD-MT-24-337-68) Avail: CFSTI CSCL 6/5

The present work deals with the problems of space medicine and contains some material relevant to the preservation of human health during space flight. An attempt is made to bring to a system the results of experimental investigations obtained during space flight. Detailed cardiological methods of space research including those based on mathematical and statistical data are stated. Some material obtained in the clinic with the help of space cardiology and the resultant data of clinicophysiological analysis taken in space flight are also presented. Cardiological theories are considered in connection with all the human reactions to space flight factors. Author (TAB)

**N69-38165#** School of Aerospace Medicine, Brooks AFB, Tex. Pharmacology-Biochemistry Branch.

**THE EFFECT OF MONOAMINE OXIDASE AND DIAMINE OXIDASE INHIBITORS ON NOREPINEPHRINE AND HISTAMINE IN RAT HEART Technical Report, Sep. 1967-Sep. 1968**

David H. Rose and Miguel A. Medina Apr. 1969 12 p refs

(AD-689163; SAM-TR-69-19) Avail: CFSTI CSCL 6/15

The effect of several hydrazine and nonhydrazine compounds on the concentrations of norepinephrine and histamine in the rat heart was studied. The compounds used were either monoamine oxidase (MAO) or diamine oxidase (DAO) inhibitors. Hydrazine (0.31 mmole/kg.), monomethylhydrazine (0.31 mmole/kg.), pargyline (0.16 mmole/kg.), and tranylcypromine (0.16 mmole/kg.) produced significant elevations of norepinephrine in the heart. The increase produced by monomethylhydrazine (MMH), pargyline, and tranylcypromine may be due to the fact that they are potent MAO inhibitors, but this does not explain the effect of hydrazine which is devoid of any MAO inhibitory action. Histamine levels in the heart were elevated only by MMH (0.31 mmole/kg.) and pargyline (0.16 mmole/kg.). MMH inhibited DAO, but pargyline does not have any effect on this enzyme. The mechanism whereby hydrazine increased norepinephrine in heart and pargyline elevated histamine does not appear to be dependent on their ability to inhibit the enzymes connected with the metabolism of these two amines. These experiments indicate that the extent of MAO or DAO inhibition by a specific compound is not related to its ability to affect tissue amine levels. The data also show that exposure to MMH or hydrazine could affect the cardiovascular system by changing the levels of amines in the heart. Author (TAB)

**N69-38166#** Naval Aerospace Medical Inst., Pensacola, Fla. Army Aeromedical Research Unit, Fort Rucker, Ala.

**AUTOMATIC RESPONSES TO VESTIBULAR STIMULATION**

Pei Chin Tang and Bo E. Gernandt Apr. 1969 29 p refs Prepared jointly by Army and Navy

(AD-689118; USAARL-69-8; NAMI-1066) Avail: CFSTI CSCL 6/16

Decerebrate, paralyzed cats were used to determine some autonomic effects of vestibular stimulation and to establish through which peripheral links this vestibulofugal activity was transmitted. Vestibular stimulation increased both rate and depth of respiration, as demonstrated by phrenic and recurrent laryngeal nerve recording, and a marked elevation in blood pressure accompanied this effect. When the strength of stimulation was reduced and the evoked respiratory effect weak or questionable, the systemic blood pressure declined. Vestibular stimulation elicited strong responses from the neck vagus nerve, but this vestibulo-vagal activity was found to be conducted exclusively in the recurrent laryngeal nerve and not in the vagus nerve proper. Only the sympathetic portion of the autonomic system responded to vestibular stimulation, thus providing vestibular impulses a channel for reaching different effector organs. The responses obtained from the neck sympathetic nerve were analyzed and their characteristics described. Author (TAB)

**N69-38196#** American Type Culture Collection, Rockville, Md.

**A STUDY OF THE EFFECTS OF STORAGE TEMPERATURE AND THAWING METHODS ON THE LONG-TERM PRESERVATION OF SELECTED STRAINS OF MICROORGANISMS AND MAMMALIAN CELLS Final Report**

John E. Shannon May 1969 72 p refs

(Contract DA-49-092-ARO-28)

(AD-689499) Avail: CFSTI CSCL 6/5

The objective of this study was to determine the effects of temperature of storage and thawing on the viability of microorganisms and mammalian cells frozen for long periods. Test strains were: Syzygites megalocarpus, ATCC 11807, Penicillium megasporum, ATCC 12322, Vibrio cholerae, ATCC 12174, Staphylococcus aureus, ATCC 6538, and derivatives of strain L mouse connective tissue cells, NCTC clone 929, ATCC-CCL 1, and human skin epithelial cells, NCTC 2544, ATCC-CCL-19. Quantitative tests for viability were made prior to freezing, within 24 hours after freezing, at the end of three months, at the end of one year, and at yearly intervals for five years. Thawing was carried out directly from temperature levels higher, lower, or the same as the temperature of storage. For fungi and animal cell lines, storage at -196C was vastly superior to storage at -20C and -79C. For bacteria, storage was almost as effective at -79C as at -196C; -20C storage was less effective. Experiments at both 3-month and 12-month storage periods indicated that there is no advantage to thawing the cells from temperatures lower (or higher) than the temperature of storage. The results indicate that when cells are frozen under similar controlled conditions the storage temperature level per se is the most critical factor in long-term preservation provided the cells are thawed rapidly. Author (TAB)

**N69-38199*#** National Aeronautics and Space Administration, Washington, D.C.

**THE PHYSIOLOGY OF HUMAN DIABETES INSIPIDUS MUST BE INTERPRETED MUCH MORE IN RELATION TO THIRST THAN TO POLYURIA [LA PHYSIOLOGIE DU DIABETE INSIPIDE HUMAIN DOIT-ETRE CONCUE EN FONCTION DE LA SOIF BEAUCOUP PLUS QUE LA POLYURIE]**

R. Kourilsky et al Sep. 1969 7 p refs Transl. into ENGLISH from Soc. Med. des Hopitaux de Paris Bull. et Mem. (France), v. 58, 1942 p 104-109

(NASA-TT-F-12512) Avail: CFSTI CSCL 06P

A detailed analysis is discussed concerning the behavior of a case of syphilitic diabetes insipidus. Thirst was the primary clinical phenomenon, and polyuria was secondary in diabetic patients studied. The results are combined and studied in order to find a clue to the pathogenesis. J.A.M.

**N69-38221*#** Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

**PROBLEM CONCERNING REACTION OF THE ORGANISM**

**UNDER EXTREMAL CONDITIONS [K VOPROSU REAKTIVNOSTI ORGANIZMA PRI EKSTREMALNYKH VOZDEYSTVIYAKH]**
V. V. Antipov et al Washington NASA Mar. 1969 10 p refs Transl. into ENGLISH from Russian Paper Presented at 3d Intern. Symp. on the Basic Environ. Probl. of Man in Space, Geneva, 15 - 19 May 1968
(Contract NASw-1692)
(NASA-TT-F-12098) Avail: CFSTI CSCL 06S

The authors examined the effect of vibrations, G-forces and weightlessness on the reaction of the organisms of mice and guinea-pigs, as well as the positive and negative effects of certain chemico-medical remedies. Their experimental data showed that the effects of the combined action of ionizing radiation and space flight factors, particularly vibrations and accelerations, are complex and numerous, and that, in many cases, the preliminary action of the dynamic factors decreases the radiation effects. It is seen that radiation illness can be worsened during repeated actions of vibrations and accelerations. Author

**N69-38228*#** Techtran Corp., Glen Burnie, Md.
**THE PERIODIC MOVEMENTS OF LEAF ORGANS**
W. Pfeffer Washington NASA Sep. 1969 139 p refs Transl. into ENGLISH of the book "Die Periodischen Bewegungen der Blattorgane" Leipzig, Wilhelm Engleman Press, 1875 p 1 - 180
(Contract NASw-1695)
(NASA-TT-F-12414) Avail: CFSTI CSCL 06C

The movement of leaf organs, whether caused by assymetrical growth, changes in lighting, temperature variations, or internal factors, are analyzed. Light is found to be principally a toning factor in daily movement, the rate of expansion of a leaf part being inversely proportional to illumination level. Geotropic and heliotropic movements without growth are discussed. Author

**N69-38235*#** National Aeronautics and Space Administration, Washington, D.C.
**AEROSPACE MEDICINE AND BIOLOGY A Continuing Bibliography with Indexes, Apr. 1969**
May 1969 198 p refs
(NASA-SP-7011(63)) Avail: CFSTI CSCL 06C

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

**N69-38237#** School of Aerospace Medicine, Brooks AFB, Tex.
**RADIATION MORTALITY OF RODENTS UNDER HYPOBARIC-HYPOXIC CONDITIONS Final Report, Jun. - Oct. 1968**
George S. Melville, Jr., Emmett J. Stork, Arthur E. Goss, Jr., Perry D. Rusk, Jimmy Rasmon et al Apr. 1969 21 p refs
(AD-690130; SAM-TR-69-18) Avail: CFSTI CSCL 6/18

The purpose of this study was to establish whether reduced oxygen concentration (hypoxia) and reduced atmospheric pressure (hypobarism) significantly change the radiosensitivity of rodents. Approximately 1,800 male Swiss-Webster mice, commited in groups of 50, and 56 male Sprague-Dawley rats were gamma-irradiated at low dose rates in an altitude chamber. Experimental groups of hypoxic and hypobaric mice received total doses of 900 to 2,100 R cobalt-60 gamma rays. Survival in all experimental groups was negligible; in one instance less than that of corresponding controls. In most experimental groups, however, the hypoxic-hypobaric groups achieved a longer mean survival time than did corresponding controls. At 1,300 R, the control group achieved a mean survival time of 7.3 days. Three groups similarly irradiated but hypoxic and hypobaric at 22,500 ft. recorded mean survival times of 9.7 days, 9.9 days, and 9.7 days, respectively. Additionally, three groups similarly irradiated but hypoxic and hypobaric at 18,000 ft. achieved mean survival times of 10.2 days, 12.7 days, and 12.4 days, respectively. The LD50/30 for normal mice irradiated as controls in the apparatus at ambient pressure and oxygen concentration was calculated to be 850 plus or minus 72 R. By assuming the validity of the hypothesis that hypoxia is radioprotective, simultaneous hypobarism appears to nullify, at least partially, this radioprotective effect. Author (TAB)

**N69-38240#** School of Aerospace Medicine, Brooks AFB, Tex.
**A MODIFIED Fe 59 FERROKINETIC PROCEDURE Final Report, Nov. - Dec. 1968**
Donald F. Logsdon, Jr., James F. Green, and John W. Harper Apr. 1969 11 p refs
(AD-690129; SAM-TR-69-24) Avail: CFSTI CSCL 6/18

In an effort to reduce the exposure dose from the 59Fe ferrokinetic procedure, the injection dose was reduced from 6 microcurie to 0.6 microcurie. Although the count rate was reduced, counts above background were obtained. The blood volume, plasma iron clearance, and red cell iron uptake were measured and found to be within normal limits. Measurement of 59Fe in the spleen, heart, liver, and sacrum by external counting produced curves closely similar to those found with the higher dose. The total-body exposure dose was reduced from 110 mrem to 11 mrem. Author (TAB)

**N69-38242*#** National Aeronautics and Space Administration, Washington, D.C.
**AEROSPACE MEDICINE AND BIOLOGY A Continuing Bibliography with Indexes, May 1969**
Jun. 1969 166 p refs
(NASA-SP-7011(64)) Avail: CFSTI CSCL 06C

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

**N69-38278*#** Naval Aerospace Medical Inst., Pensacola, Fla.
**DIRECTIONAL DIFFERENCES IN VISUAL ACUITY DURING VERTICAL NYSTAGMUS**
W. Carroll Hixson and Jorma I. Niven 16 Jul. 1969 11 p Sponsored in part by Army Aeromed. Res. Lab.
(NASA Order R-93)
(NASA-CR-105972; NAMI-1079) Avail: CFSTI CSCL 06S

Twenty naval aviator candidates were exposed to four ramp velocity test profiles generated by the Human Disorientation Device. The head orientation was such that the $\gamma$ (left-right) axis was on the earth-vertical rotational center of the device, with the resulting $\alpha_\gamma$ pitch stimulation eliciting vertical nystagmus which was recorded on all four profiles. During two of the profiles, the subjects were required to observe a visual target consisting of a vertically aligned series of dots and to report the duration of the period where dot fusion or target blur occurred as a result of the vertical nystagmus. It was found that during pitch forward angular acceleration ($+\alpha_\gamma$) resulting in nystagmus with a slow component upward, the loss of visual acuity was of a significantly longer duration than that present during stimulation in the opposite direction. Directional differences in the vertical nystagmus response were also observed. Author

**N69-38324#** Technische Hochschule Hannover (West Germany). Inst. fuer Strahlenbiologie.

**FLASH PHOTOLYSIS AND PULSE RADIOLYSIS IN RADIATION BIOLOGICAL RESEARCH**

E. G. Niemann Apr. 1969 102 p refs In GERMAN
(BMwF-FBK-69-11) Avail: AEC Depository Libraries

Possibilities and limitations of flash photolysis and pulse radiolysis techniques in the investigation of primary processes in biological systems are discussed. The design of two flash light sources, an x-ray flash equipment, and a new method of kinetic absorption spectroscopy is described in detail, which is especially adapted to the investigation of radiation biological problems. The final discussion concerns some open questions in the reaction kinetics of biological systems and investigates the possibility of their solution by means of flash photolysis and pulse radiolysis. Author (NSA)

**N69-38350#** Johns Hopkins Univ., Baltimore, Md. Dept. of Radiological Sciences.

**CELL PROLIFERATION STUDIES IN CONTINUOUSLY IRRADIATED MAMMALS - EFFECT OF AGE**

Jacob I. Fabrikant 30 Apr. 1969 16 p refs Presented at the 9th Ann. Hanford Symp. on Radiation Biology of the Fetal and Juvenile Mammal, Richland, Wash.
(Contract AT(30-1)-3970)
(NYO-3970-25; CONF-690501-1) Avail: CFSTI

It was demonstrated that the radiation effects in certain of the cell renewal systems (hemopoietic stem cells, semiferous epithelium, and thymus) in mice depend, in part, on the cell population structure and proliferative characteristics of the tissue at the time of exposure. The maintenance of cell proliferation and differentiation under the stress of γ and x radiation injury is governed, in part, by the homeostatic control mechanisms which regulate cell reproduction. Thus the kinetics of depopulation and recovery from radiation injury would depend on the integrity of the internal and external factors which determine the availability of normal stem cells, proliferating precursor cells, and possible feedback mechanisms, such as hormonal agents, regulating cell population size and differentiation. Since these factors change with age and particularly during the early period of growth and maturation of the animal, it would be expected that the radiation response would be affected by the age of the host and thus the cell population structure, and the extent of perturbations of the system by radiation. NSA

**N69-38355#** Florida State Univ., Tallahassee. Dept. of Psychology.

**STUDIES IN THE USE OF IONIZING RADIATIONS AS STIMULI Progress Report, 1 Jun. 1968 – 31 May 1969**

James C. Smith 29 May 1969 12 p refs
(Contract AT(40-1)-2903)
(ORO-2903-44) Avail: CFSTI

Investigations were conducted on the use of x rays and γ rays as noxious unconditioned stimuli in conditioning aversions to preferred taste solutions. Effects of the circadian rhythm on radioinduced aversion to saccharin in rats were studied. Radio-induced aversion to sucrose solutions was studied using a bar press reinforcement. Gamma rays and x rays were used as a warning stimulus for subsequent shock to show that rats, monkeys, and pigeons elicit immediate responses on the onset of the ionizing radiation. Light, beta rays, and gamma rays were compared as effective stimuli to elicit either flight behavior or electrical responses from the visual system of the moth, Heliothis zea. NSA

**N69-38357#** Southwest Texas State Coll., San Marcos. Dept. of Biology.

**EFFECTS OF RADIATIONS ON THE GENETIC SYSTEMS OF ORGANISMS IN RELATION TO THEIR PHYSICAL AND BIOCHEMICAL SYSTEMS Progress Report, 1 Sep. 1968 – 1 May 1969**

Mary L. Alexander 1 May 1969 12 p refs
(Contract AT(40-1)-3844)
(ORO-3844-1) Avail: CFSTI

The mutagenicity of short-strand DNA and a comparison of the ability of single and double-stranded DNA to induce recessive lethal mutations were studied by incorporating 0.5 ml of heated (above 65°C) or cold DNA into the medium on which Drosophila eggs were placed and allowed to develop from larvae to the adult stage. Appropriate controls were also maintained. The results indicated that the mere reduction in the size of the DNA molecule did not increase its mutagenicity. It was also concluded that mutagenicity by DNA is dependent upon some factor or factors other than the size of the macromolecules and therefore the preparation of the samples of the same type of DNA cannot account for the variations in results observed for DNA feeding. The efficiency of ethylenimine and x rays and combinations of the two mutagens for producing genetic damage in Drosophila germ cells were studied and results are reported. NSA

**N69-38389#** McDonnell-Douglas Astronautics Co., Newport Beach, Calif. Astropower Lab.

**PATTERN RECOGNITION OF EEG TO DETERMINE LEVEL OF ALERTNESS Technical Progress Report, 2 Nov. 1968 – 14 May 1969**

William B. Martin Jun. 1969 22 p refs
(Contract N00014-68-C-0277)
(AD-689536; DAC-60538-52) Avail: CFSTI CSCL 06/16

This report documents the work accomplished during the second reporting period in applying the principles of pattern recognition technology to the analysis of EEG. Using EEG recordings, two sleep state classification systems, based on inputs derived from spectral analysis, have been designed, simulated, and tested. One system was based on an overnight sleep record of a single subject; the other included, in the design data base, sleep EEG patterns taken from six subjects. The resulting pattern recognition systems were tested on sleep records from ten subjects and yielded reasonable classification of the training and test tapes. However, to reduce confusion between certain sleep stages (i.e., 1 + REM, 3 + 4...) additional inputs may be required to supplement the basic frequency information. To assist in enhancing the classification ability of the recognition system a smoothing operation has been developed that monitors the systems output response and minimizes isolated misclassifications. In addition, a computer program to isolate and identify K complexes and sleep spindles is under development and shows considerable promise. Author (TAB)

**N69-38410*#** Department of Health, Education, and Welfare, Cincinnati, Ohio. Consumer Protection and Environmental Health Service.

**ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Apr. – 30 Jun. 1969**

R. B. Read, Jr. Aug. 1969 34 p refs
(NASA Order R-38-015-001)
(NASA-CR-106007; QPR-17) Avail: CFSTI CSCL 06C

Studies are centered upon the establishment and the evaluation of a rapid procedure for preparing spores for dry heat inactivation, obtaining ancillary data on water sorption with the spores of B. subtilis var niger, and indentifying isolates from Apollo 10. A statistical application to thermal death time of the spores is included. Author

**N69-38428#** Office of Atomic Energy for Peace, Bangkok (Thailand).

**DETERMINATION OF MANGANESE, COPPER, ZINC, IRON, AND MOLYBDENUM IN ANIMAL BLOOD SAMPLE BY NEUTRON ACTIVATION ANALYSIS**

Darakarnt Chamnirokasarnt 1969 5 p refs
(THAI-AEC-22) Avail: AEC Depository Libraries

The technique of neutron activation analysis was applied to determination of Mn, Cu, Zn, Fe, and Mo in animal blood

samples as supplied by IAEA for intercomparison purposes. One gram of the sample was found to contain 0.3786 ± 0.0019 μg Mn, 1.4146 ± 0.0025 μg Cu, 16.5713 ± 0.0607 μg Zn, 2.7025 ± 0.0446 mg Fe, and 0.0305 ± 0.0013 μg Mo. Author (NSA)

**N69-38449#** Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR).
**SOME CHANGES IN THE MOTOR REACTIONS OF PERSONS WORKING IN CONDITIONS OF CONTINUOUS RADIATION EXPOSURE**
A. V. Barabanova 1968 18 p refs In RUSSIAN
(A-AC-82/G/L-1255) Avail: AEC Depository Libraries

Persons who were chronically exposed to radiation during work, such as reactor and accelerator personnel, medical radiologists, persons working with phosphors and with industrial flaw detectors, and scientists and technicians working with unsealed sources, were examined to determine the radiation-induced changes in their motor reactions. Electromyographic and stabilographic methods were used; the electromyograms were recorded by a 15-channel electroencephalograph. The data represented an expansion of the standard values; they were very unstable. The motor reactions followed the general worsening tendency of the nervous system and of the organism as a whole. Persons exposed to 50 to 70 rad seemed to increase their bioelectric activity; this tendency was more marked in persons suffering from chronic radiation sickness who also exhibited considerable regulatory instability in their vascular and motor reactions. Author (NSA)

**N69-38501#** Texas Univ., Dallas. Southwestern Medical School.
**INFLUENCE OF THE PHYSICAL STATE OF CHROMATIN ON NUCLEIC ACID AND PROTEIN SYNTHESIS AND ON RADIATION SENSITIVITY OF CELL DIVISION Progress Report, 1 Sep. 1968–31 Aug. 1969**
Mary Esther Gaulden 30 May 1969 7 p refs
(Contract AT(40-1)-3546)
(ORO-3546-7) Avail: CFSTI

The induction of pseudo-diapause in grasshopper embryos was accomplished by placing the embryos at 11°C. The embryos could be stored up to six months. The effects of the degree of condensation of chromatin on its ability to synthesize DNA, RNA, and protein were studied in cultured grasshopper neuroblast by altering the ionic strength of the medium. Data indicate that the condensation of the chromosomes before or just after initiation of RNA synthesis prevented or greatly reduced synthesis, but synthesis was slightly reduced when chromatin was condensed after the cell was well into the process. Uptake was observed of the labeled amino acids at all stages from early telophase to late propase, but not during midmitotic periods. Investigations on the effects of X-radiation on uptake of tritium-labeled thymidine in late prophase and metaphase showed no uptake in metaphase and uptake only in those prophase cells that were delayed. Studies on the effects of colchicine on the mitotic rate of neuroblasts revealed that cells in middle prophase underwent reversion to earlier stages. Telophase and interphase cells were also greatly retarded. It was concluded that telophase, middle prophase, and the first part of late prophase were the most sensitive phases of the cell cycle to X-rays. NSA

**N69-38502#** City Coll. of the City of New York. Brooklyn College.
**LETHAL SECTORING AND APPARENT INTERCHROMOSOMAL EFFECTS IN YEAST Annual Progress Report, 1968**
1968 5 p refs
(Contract AT(30-1)-3998)
(NYO-3998-1) Avail: CFSTI

Pooled haploid budding lethal sector data showed highly enhanced recombination after x irradiation; however, when each of the individual clones was analyzed, normal map distance was observed. Studies to elucidate the mechanism of radioresistance of yeast are briefly described; in one area, mutations deficient for budding cell resistance were sought using a variety of mutagens. Six mutants were found. The medium in which overnight refrigeration occurred were found to be important. If stored overnight in water at 8°C prior to exposure to growth conditions, the resulting budding cells were found to be of the same sensitivity as the interdivisional cells. All budding cells were indistinguishable on the basis of the Feulgen reaction; all showed the same evidence of DNA increase in their nuclei thus indicating that DNA increase of itself was insufficient to confer radioresistance. Azure B staining results indicated that DNA duplication and RNA synthesis were both required for radioresistance in budding yeast. NSA

**N69-38514#** Georgia Univ., Athens. Dept. of Zoology.
**A STUDY OF THE GENETIC COMPONENTS OF GROWTH AND REPRODUCTION AS THEY ARE AFFECTED BY RADIATION, TEMPERATURE, SELECTION, AND THE INTERACTION OF THESE THREE FACTORS Progress Report, 1 Feb. 1968–1 Feb. 1969**
1 Feb. 1969 20 p refs
(Contract AT(40-1)-2975)
(ORO-2975-12) Avail: CFSTI

The immediate and possibly cumulative effects of γ radiation and the interaction of radiation, selection, and temperature on reproduction and growth of field mice were studied; the relations between growth, reproduction, and temperature were also considered. Data are presented in tabular form. Generally, temperature and radiation slightly influenced body weight and composition; temperature effects on the fat component of body weight approached significance. The group held at 90°F (60°, 75°, and 90°F holding temperatures) was discontinued because of lack of offspring. NSA

**N69-38527#** Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR).
**EFFECTS OF IONIZING RADIATION ON THE NERVOUS SYSTEM, PART 1**
A. K. Guskova, ed. 1968 72 p refs In RUSSIAN
(A-AC-82/G/L-1264) Avail: AEC Depository Libraries

Individual reports are presented on five radiation effects topics: (1) principles of clinico-physiological evaluations of the human nervous system after irradiation; (2) clinico-physiological characteristics of neuro-circulatory dystonic syndrome in radiation sickness; (3) functional state of the heart and control of its activity upon chronic exposure to ionizing radiation; (4) cerebral hemodynamics change after exposure to ionizing radiation; and (5) encephalographic studies on human exposure to low radiation dosage. E.C.

**N69-38556#** Production Group, United Kingdom Atomic Energy Authority, Annon (Scotland).
**RADIOBIOLOGY RESEARCH UNIT, CHAPELCROSS ANNUAL REPORT 1968**
J. H. Martin 1969 6 p refs
(PG-Rept-897) Avail: CFSTI/UK

The transfer of the Unit from the Atomic Energy Authority to Dundee University is announced. Work related to the passage of heavy ions through tissue was continued, and studies of biochemical indicators of radiation exposure and on the influence of particulate materials on cell renewal are outlined. NSA

**N69-38585#** Sandia Corp., Albuquerque, N.Mex.
**INFLUENCE OF WEAK ELECTROMAGNETIC FIELDS ON THE CIRCADIAN CYCLE OF HUMANS**
Ruetger Wever 1969 11 p refs Transl. into ENGLISH from Naturwissenchaften (Berlin), v. 55, 1968 p 29–32
(SC-T-69-1021) Avail: CFSTI

Based on the shielding studies, the natural electromagnetic fields exert the same effect upon the circadian cycle of man as an artificial electrical 10-Hz field: Both fields act as an accelerator

upon the periodicity and this accelerating effect increases with a prolongation of the period when the field is absent. Both fields inhibit the internal de-synchronization that can be observed only in the absence of both natural and artificial fields. The natural electromagnetic fields of terrestrial origin can be replaced by artificial electrical 10-Hz fields with regard to their effect upon periodicity. This mutual interchangeability does not mean that the 10-Hz radiation is the only component of the natural fields that acts upon man; yet it is a strong indication that the 10-Hz radiation is an essential component of those fields, at least as regards the effect on the circadian periodicity. The experiments show, on the one hand, that the circadian periodicity can also be affected by imperceptible physical errors, and, on the other hand, that previously disregarded factors of our natural environment can have a measurable effect on man. Author (NSA)

# 05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

**N69-37258#** Institute for Perception RVO-TNO, Soesterberg (Netherlands).

**JUDGING THE POSITION OF A MOVING POINT AT THE MOMENT OF A SIGNAL [HET BEOORDELEN VAN EEN POSITIE VAN EEN BEWEGEND PUNT OP HET MOMENT VAN SIGNALERING]**

J. Zwart and A. F. Sanders [1969] 14 p. In DUTCH; ENGLISH summary

(IZF-1969-5; TDCK-52976-2) Avail: CFSTI

Seven subjects judged the position of a rapidly moving point at the moment of a signal. Three variables were used: the actual position of the point at the moment of signaling, the speed of the point, and the character of the signal. The signaling method was either a tone, a light flash, or a reduced brightness contrast between point and background. It appears that the trajectory can be sufficiently estimated. The position of the point on the trajectory at the moment of signaling is more difficult to judge. The degree of the error depends on all three variables. As to method of signaling, the reduced brightness contrast delivered best performance. Author

**N69-37286#** RAND Corp., Santa Monica, Calif.

**SOVIET CYBERNETICS: RECENT NEWS ITEMS, VOLUME 3, NO. 4**

Dorothy Mc Donald, ed. and Wade B. Holland, ed. Apr. 1969 147 p. refs

(Contract F44620-67-C-0045; Proj. Rand)

(AD-688820; RM-6000/4-PR) Avail: CFSTI CSCL 8/4

Contents: BESM-6: focus on software; Soviet research in game theory applications; Large-scale automation of industrial planning, management, and control; Selected Soviet cyberneticists; Awards to scientists and scientific organizations; The concept of optimal mathematical planning; Properties and applications of glasslike semiconductors; When are computers profitable; The central economic-mathematics institute; Lithuanian research on mathematical cardiology; The All-Union School for mathematical programming; and The role of patent information. TAB

**N69-37311#** George Washington Univ., Alexandria, Va. Human Resources Research Office.

**MEASURES OF REACTION TO THREAT OF PHYSICAL HARM AS PREDICTORS OF PERFORMANCE IN MILITARY AVIATION TRAINING**

Wiley R. Boyles May 1969 20 p. refs Presented at the Southeastern Psychological Assn. Ann. Meeting, New Orleans, Feb. 1969 /ts Exploratory Study No. 70

(Contract DAHC19-69-C-0018)

(AD-688817; HUMRRO-PP-15-69) Avail: CFSTI CSCL 5/10

Data from subjective reports, objective performance measures, and physiological studies indicate that flight training per se places a great deal of stress on the trainee. In military flight training additional stresses are involved that may markedly increase the importance of reaction to threat of physical harm. The paper reports effort to develop measures of reaction to physical harm threat and measures of change in confidence in ability to cope with that threat for use in the secondary selection process in U.S. Army aviation. Author (TAB)

**N69-37315#** Cornell Univ., Ithaca, N.Y.

**COGNITIVE SYSTEMS RESEARCH PROGRAM. COLLECTED TECHNICAL PAPERS, VOLUME 3**

F. Rosenblatt, ed. 30 Jun. 1968 143 p. refs

(Contract Nonr-401(40); Grant NSF GK-2792)

(AD-677639; Rept-12) Avail: CFSTI CSCL 5/4

CONTENTS:

1. ON THE SHARPENING MECHANISM OF THE HEARING SYSTEM A. Molchanov and C. Tappert p 1-8 refs (See N69-37316 22-04)

2. A HEURISTIC MODEL OF THE HUMAN VISUAL PERCEPTION SYSTEM S. J. King p 9-31 refs (See N69-37317 22-04)

3. SOME EXPERIMENTS ON TOBERMORY MEMORY PERFORMANCE S. J. King p 33-45 (See N69-37318 22-08)

4. SOME INVESTIGATIONS OF C-SYSTEMS AND RELATED NETWORKS D. A. Petty p 47-62 refs (See N69-37319 22-08)

5. A REINFORCEMENT RULE FOR A MAJORITY DECISION NETWORK C. Kesler p 63-65 ref (See N69-37320 22-08)

6. A LINEAR REGION LOGIC UNIT C. Kesler p 67-79 refs (See N69-37321 22-08)

7. ACTIVITY REGULATION IN PERCEPTRONS N. M. Branston p 79-138 refs (See N69-37322 22-04)

**N69-37354*#** AiResearch Mfg. Co., Los Angeles, Calif.

**SUPPORTING DEVELOPMENT FOR THE PRELIMINARY DESIGN OF AN INTERMEDIATE WATER RECOVERY SYSTEM**

J. P. Byrne and A. Anderson, ed. 26 Aug. 1969 55 p

(Contract NAS9-8460)

(NASA-CR-101910; Doc-69-5470) Avail: CFSTI CSCL 05E

The supporting development effort was planned to include the identification of system and component areas which required particular concentration of development activity. Prototype models of critical components of the system - the compressor, phase separator, heat exchanger, and controls - were fabricated and tested. The components were then assembled into a system breadboard which was operated to establish system functional performance, operational characteristics, and the quality of product water. The basic objective of the supporting development effort was to assure system functionality and to demonstrate the developmental status and overall system operational characteristics. These objectives were met, although the results of some efforts, particularly component development, indicate that more development effort is required before a flight prototype system can be fabricated. The developmental status of the system is briefly summarized. Author

**N69-37374#** Joint Publications Research Service, Washington, D.C.

**LIFE SUPPORT SYSTEMS IN HIGH-ALTITUDE AND SPACE FLIGHTS**

D. I. Ivanov et al. 19 Sep. 1969 137 p. Transl. into ENGLISH from the book "Sistemy Zhiznеobespechiniya Cheloveka pri Vysotnykh i Kosmicheskikh Poletakh", Moscow, Machine Building Publishing

House, 1968
(JPRS-48858) Avail: CFSTI

A broad review of existing equipment and systems, mostly Soviet and American, is presented. Physiological and hygienic standards and requirements of life support systems in aircraft are discussed, covering such subjects as pressurized cabin atmospheres, ventilation, oxygen equipment, pressure suits, and effects of vibration and noise. Oxygen equipment for operation in pressurized aircraft cabins and measures in case of depressurization are discussed. The design and development of aviation and space pressure suits is outlined, and examples are given of material strength calculations, ventilation systems, regeneration processes, and pressure regulators. A description of spacecraft cabins, space suits, and life support packs in the Soviet and American space programs deals also with problems of heat exchange and cooling systems. K.W.

**N69-37377#** National Aerospace Lab., Tokyo (Japan)
**DESIGN AND CONSTRUCTION OF VTOL FLIGHT SIMULATION SYSTEM**
Kazuo Higuchi, Moriyuki Momone, Noriko Miyoshi, Masanori Okabe, Rokuro Yamamoto et al 1968 54 p refs In JAPANESE; ENGLISH summary
(NAL-TR-169) Avail: CFSTI

The main system components are (1) an integrated information display using a CRT and TV system and various kinds of controllers involved in a fixed-base cockpit, (2) A TV camera with 6 degrees of freedom to provide a visual scene of the takeoff and landing approach below 120m ceiling. The model represents an area 2,600m by 1,000m at a 1:400 scale. The pilot may be presented with a projected or monitor image as a visual aid. The system is controlled through an analog computer programmed to account for vehicle dynamic response to pilot control input. Studies such as flight performance, human characteristics in information transfer, stability and controllability at low speed and transition flight of VTOL aircraft are carried out using this system. Author

**N69-37380#** Uppsala Univ. (Sweden). Inst. of Physics.
**MUSCLE VIBRATORS CONTROLLED BY MYO-SIGNALS**
A. Hedberg, B. Oldberg, and P.-A. Tove [1969] 14 p refs
(UUIP-641) Avail: CFSTI

In order to restore some voluntary motor control of paralyzed elbow muscles, a vibrator has been designed in which the electromyographic activity directly controls the action of the vibrator. The project was designed primarily to assist in the investigations of the use of tonic vibration reflexes to increase the range of movement for patients with spastic paresis, but it only functions in certain cases. ESRO

**N69-37617*#** Texas Technological Coll., Lubbock.
**REMOVAL OF ACID GASES AND OXIDES OF NITROGEN FROM SPACECABIN ATMOSPHERES**
A. J. Gully, R. M. Bethea, R. R. Oldham, and M. C. Meador
Washington NASA Jul. 1969 148 p
(Contract NAS1-7584)
(NASA-CR-1388) Avail: CFSTI CSCL 06K

The methods of removal of oxides of nitrogen and of the acid gases sulfur dioxide, hydrogen chloride, hydrogen fluoride, and chlorine in low concentrations from air as part of the effort to develop an effective atmospheric purification subsystem for long-term manned space missions were studied. Methods investigated were: (1) reaction with basic solid materials, (2) adsorption, and (3) for oxides of nitrogen, catalytic reduction of nontoxic to less toxic gases. Adsorption at ambient temperature of both chlorine and nitrogen dioxide on activated carbon was found to be rapid with sulfur dioxide being adsorbed to a lesser extent. In exploratory work, nickel oxide and copper oxide were found to exhibit appreciable activity in the catalytic decomposition of nitrogen dioxide. Maximum decomposition of nitrogen dioxide observed (nickel oxide catalyst at 482°C) was 53%. Nitric oxide was the major decomposition product. Solid-gas reaction was found to be the most generally effective method of contaminant removal. The solid reactants tested included sodium carbonate, sodium bicarbonate, barium carbonate, calcium carbonate, lithium carbonate, and manganese dioxide. Author

**N69-37793#** Cornell Univ., Ithaca, N.Y. Center for Applied Mathematics.
**FEATURE DETECTION NETWORKS IN PATTERN RECOGNITION Interim Scientific Report**
Edward Martin Riseman Jun. 1969 139 p refs
(Grant AF-AFOSR-1402-68)
(AD-689429; AFOSR-69-1249TR) Avail: CFSTI CSCL 9/4

In some pattern recognition problems a large number of patterns may be decomposed into a small set of subpatterns which can reconstitute each of the patterns. The use of such features can result in an economical recognition network. In such cases the pattern set may have an inherent hierarchical structure which can be incorporated in a layered logical network. An algorithm is presented which uses a training set of patterns to determine this structure. The subpatterns, termed features, are generated sequentially through an adaptive process of weight alteration in a neural network as each pattern is iteratively presented. A measure of relatedness of a set of points is utilized to decide which subset of points associated with these sets of weights represents useful information and should be selected as a feature. Experimental results indicate the potential of the algorithm in organizing a recognition network to correspond to the information structure of the pattern set. Author (TAB)

**N69-37888#** Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
**A COMPARATIVE STUDY OF THE $^{90}Sr/Ca$ RATIO IN HUMAN DIET AND BONE TISSUE [ETUDE COMPAREE CHEZ L'HOMME DU RAPPORT $^{90}Sr/Ca$ DANS L'ALIMENTATION ET LE TISSU OSSEUX]**
René Coulon and Claude Madelmont Jun. 1969 44 p refs In FRENCH; ENGLISH summary
(CEA-R-3848) Avail: CFSTI

A comparative study of both the evolution of the strontium-90 content in the bones of individuals of different ages for the period 1962–1967 as related to calcium, and also the corresponding diets gave a relationship between food contribution and the resulting bone burden. The study is mainly devoted to a group of adults for which a mathematical expression is proposed, which allows for the exchangeable form of a skeletal calcium fraction turned over in less than a year from the dietary calcium, and the stabilized form constituting the larger part of bone tissue characterized by a slow turnover. Both the amount of the exchangeable fraction and the turnover rate of the stabilized fraction are determined for vertebrae and ribs. At birth, bone levels indicate that the calcium used or skeleton modelling during foetal life originates from both maternal diet and bone tissue and a value is given for their relative significance. There is a good relationship between bone levels in infants from 6 months to 1 year of age and their diets and the physiological parameters particular to this age are quantified. Author (ESRO)

**N69-37920#** Army Foreign Science and Technology Center, Washington, D.C.
**CERTAIN ASPECTS OF THE DESIGN OF MAN-MACHINE SYSTEMS**
V. L. Veits et al May 1969 16 p refs Transl. into ENGLISH from Mashinostr (Kiev), 1968 p 3–9
(AD-689248; FSTC-HT-23-158-69) Avail: CFSTI CSCL 5/8

The report discusses problems of man-machine interface. The process between input and output is divided into three parts: perception of sensing; understanding or processing; and formulation of command or acting on control organs. Feed back is accomplished

between the output (result) and the command formulation stage. On the basis of the parameters developed, models are produced to simulate the above parts of the process. Formulae are developed and applied to the solution of problems. Author (TAB)

N69-37984*# AiResearch Mfg. Co., Los Angeles, Calif.
**MAN'S CAPABILITY FOR SELF-LOCOMOTION ON THE MOON. VOLUME 1: DETAILED REPORT**
E. C. Wortz, W. G. Robertson, L. E. Browne, and W. G. Sanborn Washington NASA Sep. 1969 408 p refs Revised
(Contract NAS1-7052)
(NASA-CR-1402; Rept-68-3986-Rev-1) Avail: CFSTI CSCL 06S

Results are presented on a comprehensive study of man's self-locomotive capabilities in simulated lunar gravity. An inclined-plane and a gimbal-vertical simulator equipped with treadmills were used to simulate lunar gravity. Man's locomotive characteristics and the metabolic costs of walking, running, and loping at velocities from 2 to 12.8 km/hr were determined for subjects in pressurized Gemini-4C suits. The results showed that the energy cost of locomotion in simulated lunar gravity is considerably less than that in earth gravity. Ascending grades caused large increases in metabolic cost over that of level walking where the magnitude of the cost depends on the simulation technique used. Increasing the load carried from 75 to 400 earth-pounds had a small and inconsistent effect on metabolic costs. Changing the smooth, hard walking surface to sandy soil caused a large increase in the metabolic cost at the higher locomotion rates. Author

N69-37975*# Webb Associates, Yellow Springs, Ohio.
**AUTOMATIC CONTROL OF WATER COOLED SUITS FROM DIFFERENTIAL TEMPERATURE MEASUREMENTS Final Report**
Samuel J. Troutman, Jr. and Paul Webb Aug. 1969 36 p refs
(Contract NAS12-682)
(NASA-CR-86244) Avail: CFSTI CSCL 06K

An automatic controller based on temperature changes ($\Delta T$ controller) was designed for the clothing assembly of a man doing treadmill work. Inputs to the $\Delta T$ controller were: (1) the difference between suit inlet and outlet water temperature (heat removal rate at fixed water flow); and (2) four selected skin temperatures. Experiments established the correct weighting and damping factors for smooth and accurate control. Further experiments evaluated the $\Delta T$ controller during quiet periods, moderate steady work, and intermittent work. Long-term accuracy and stability were established during a final experiment lasting 16 hours, in which the subject slept, ate, worked, and rested. The advantages of the $\Delta T$ controller are that it provides relief from the responsibility for regulating one's own thermal state; guarantees low sweat rates and no dehydration at the same time as it prevents chilling and discomfort; provides maximum heat removal and minimum heat storage; and gives good long-term stability at low metabolic levels. Author

N69-37998# Atomic Energy Commission Research Establishment, Risö (Denmark). Chemistry Dept.
**PREPARATION OF $I^{131}$-LABELLED PROTEINS BY AN ELECTROLYTICAL METHOD AND PURIFICATION OF THE LABELLED PRODUCT**
Zhila Khalkhali (Tehran Univ. Nucl. Center), and Ulf Jacobsen Dec. 1968 31 p refs
(RISO-192) Avail: CFSTI

The aim of this work was to establish a simple and reliable method for iodine labelling of different proteins and purification of the labelled products to the extent where they can be used for metabolic investigations. The preparation of iodine labelled, high specific activity proteins through an electrolytical method is reported. Human serum albumin was selected as a model substance for preliminary experiments to find the optimum condition for labelling. Different proteins were iodinated to a mean level of 0.1-0.5 atom per molecule of protein, a labelling yield of ≈90% was achieved in most cases. Investigations were also made covering the purification of the labelled product immediately after the preparation by gel filtration. Metabolic studies and pyrogenity tests carried out on the labelled and purified rabbit serum albumin and transferrin demonstrated that the product is pyrogene free and metabolized as the genuine proteins. Author (ESRO)

N69-38002# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
**INTERNAL DECONTAMINATION OF A RADIOACTIVE ZIRCONIUM-NIOBIUM OXALATE IN RATS**
**DECONTAMINATION INTERNE CHEZ LE RAT D'UN OXALATE DE ZIRCONIUM-NIOBIUM RADIOACTIF]**
Renaud Rinaldi, Michel Gavend, and Jean-Pierre Rinaldi May 1969 15 p refs In FRENCH; ENGLISH summary
(CEA-R-3810) Avail: CFSTI

A study of the internal decontamination of rats with $^{95}Zr$-$^{95}Nb$ oxalate injected by intravenous and intratracheal routes confirmed the effectiveness of zirconium citrate studied in previous work. In the treated animals, an increased urinary excretion and a clear decrease of the accumulation of radio-isotopes in bones was noted. However, the effectiveness of the zirconium citrate depends on the rapidity of intervention. Author (ESRO)

N69-38006# Atomic Energy Commission Research Establishment, Risö (Denmark). Electronics Dept.
**KIDNEY CONSTANT CALCULATOR**
K. Soe Hojberg and E. Knudsen (Finsen Lab.) Apr. 1969 13 p refs
(RISO-M-878) Avail: CFSTI

The program is used for the determination of two constants describing the transport of hippuran to and from the kidneys on the basis of a simple kidney and external system model. The data used for the computation are derived from a renogram test. Author (ESRO)

N69-38265# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
**A STRUCTURE OF MAN-MACHINE DIAGNOSTIC INFORMATION SYSTEMS: IMPLICATIONS FOR HUMAN ENGINEERING RESEARCH AND DESIGN Final Report, Dec. 1967—Jan. 1968**
Robert G. Mills Dec. 1968 21 p refs
(AD-689786; AMRL-TR-68-134) Avail: CFSTI CSCL 5/8

A conceptual framework for describing and analyzing man-machine diagnostic systems (e.g., maintenance and check-out, command and control systems) is suggested. Emphasis is placed on information, its nature and its flow within such systems. The more prominent variables affecting diagnostic processes and performance (i.e. inferential decision-making) and their topological interrelationships are described. A graphic representation of the processes involved in these systems is provided in terms of a generalized flow diagram. Information parameters are critical in determining the quality of diagnostic performance in man-machine diagnostic systems. It is concluded that research concerning the relationships between information parameters and diagnostic performance, as well as the more traditional (i.e., display/control) research, is required to develop human engineering criteria applicable to the design of diagnostic systems. Several examples of relevant human engineering research problems are discussed. Author (TAB)

N69-38287# Mitre Corp., Bedford, Mass.
**CLASSIFICATION OF CONSOLE DISPLAYS AND THEIR FUNCTIONAL APPLICATIONS**
Thomas A. Mackey May 1969 117 p refs
(Contract F19628-68-C-0365)
(AD-689551; MTR-814; ESD-TR-69-123) Avail: CFSTI CSCL 5/8

The document presents a survey of console display devices and their functional applications for the USAF command and control environment. In particular, console display devices which enhance man/machine interaction are emphasized. Author (TAB)

N69-38420*# Fenwal, Inc., Ashland, Mass.
**FIRE PROTECTION AND RECOMPRESSION SYSTEMS FOR A HYPOBARIC RESEARCH CHAMBER Final Report, Jul. – Dec. 1967**
William Brown (Fairchild Hiller Corp., Farmingdale, N.Y.), Edward Ledoux, William Mailloux, John A. Brown(AMRL), Earl L. Sayre et al (AMRL), Courtney A. Metzger (AMRL) Wright-Patterson AFB, Ohio AMRL Feb. 1969 38 p Sponsored in part by NASA Prepared for Fairchild Hiller Corp. Farmingdale, N.Y.
(Contract F33615-67-C-1833; Proj. 6373)
(NASA-CR-106011; AMRL-TR-68-146) Avail: CFSTI CSCL 06K

A fire detection-extinguishment system and automatic rapid recompression system for a hypobaric man-rated chamber to enhance the safety of human subjects confined to aerospace simulators in altered gaseous atmospheres are described. Installation, operation, and maintenance instructions are included. The UV detectors are used for detection of flame or arcing; reaction systems are triggered either automatically by the UV detector or by manual electric or manual hydraulic switching. The UV and smoke detectors set off audio and visual alarms during manual modes of monitoring the chamber interior. Water supply for 60 sec is maintained at 100 psi gage. The installation design of the water sprinkler system into the chamber meets requirements for both water pattern and flow rate of 7.5 gal/min/ft$^2$ of floor area. Measured response time between automatic detector sensing and water delivery at a transient pressure of 35 psi gage at the sprinkler was 110 msec. An on-off-reset-repeat detection-control system is used. All systems use 24 V dc power; conventional and emergency power sources are discussed. An array of installed alarms is described. Author

N69-38491*# TRW Systems Group, Redondo Beach, Calif.
**HEAT PIPE DEVICES FOR SPACE SUIT TEMPERATURE CONTROL Research Report, 30 Jun. 1966 – 1 Sep. 1968**
Arnold P. Shlosinger Washington NASA Oct. 1969 56 p refs
(Contract NAS2-3817)
(NASA-CR-1400; TRW-06462-6005-R0-00) Avail: CFSTI CSCL 06K

Investigations performed to develop techniques for control of temperature in extravehicular space suits have provided technological knowledge of general applicability to temperature control systems. This report summarizes this knowledge. Other reports, referenced in this report, deal with the specific application to space suits and the related materials research performed. A heat pipe thermal switching device is described, and test results presented. Techniques for bonding of capillary structures to solid substrates are discussed. Recommendations for suitable bonding techniques are provided. Heat pipes of flexible materials are described, and data resulting from experimentation with flexible heat pipes presented. Concepts for preventing freezing or for restart of frozen heat pipes are discussed and experiments, demonstrating feasibility of one of these concepts, are described and data presented. Author

N69-38549# Ocean Systems, Inc., Terrytown, N.Y. Research Dept.
**REGION OF NONCOMBUSTION, FLAMMABILITY LIMITS OF HYDROGEN-OXYGEN MIXTURES, FULL SCALE COMBUSTION AND EXTINGUISHING TESTS AND SCREENING OF FLAME-RESISTANT MATERIALS Summary Report No. 2 on Combustion Safety in Diving Atmospheres, 31 Mar. 1967 – 1 May 1969**
Victor A. Derr and Heinz R. Schreiner 1 May 1969 211 p refs
(Contract N00014-68-C-0149)
(AD-689545) Avail: CFSTI CSCL 6/11

Research during the second and third years of this contract has centered around five general areas: The determination of the region of noncombustion in compressed breathing gases, the determination of the upper flammability limits of hydrogen-oxygen mixtures at superatmospheric pressures, screening of flame resistant materials and recommendations of end-item diving products, full scale combustion tests in the decompression chamber and high-expansion foam fire extinguishing tests. The report also includes an updated survey of the literature and sections on anticipated future studies and apparatus and technique. Author (TAB)

N69-38600*# Michael Reese Hospital and Medical Center, Chicago, Ill.
**ANALYSES AND MEASUREMENTS OF BLOOD SAMPLES**
Eric Reiss Washington NASA Oct. 1969 16 p
(Contract NAS2-4757)
(NASA-CR-1395) Avail: CFSTI CSCL 06P

Details of experimental procedures are given. The radioimmunoassay for parathyroid hormone (PTH) yielded reliable and reproducible measurements in man, and the methods developed in our laboratory are applicable for the investigation of calcium metabolism during weightlessness in space flight. Despite substantial accomplishments, many problems remain. These problems are spelled out in detail. They emphasize the need for ongoing investigations and improvement in currently employed technics. Author

# 06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-37202# Computing and Software, Inc., Panorama City, Calif. Edwards Branch.
**A MODIFICATION OF ONE-CENTER SLATER ORBITALS FOR DIATOMIC MOLECULES AS APPLIED TO THE HYDROGEN MOLECULAR ION Final Report, Oct. 1966 – Feb. 1969**
Robert V. Miller Edwards AFB, Calif. AF Rocket Propulsion Lab. Jun. 1969 25 p refs
(Contract F04700-67-C-0203)
(AD-689392; AFRPL-TR-69-125) Avail: CFSTI CSCL 7/4

One-center variational wave functions have been applied in a form which utilizes distinct functional forms within a spherical core and exterior to the core. The radial dependence of the inner functions is expressed in terms of spherical Bessel functions which represent exact solutions for the zeroth order spherical approximation of the nuclear potential. The outer portions of the orbitals are represented by conventional Slater orbitals with exponents constrained to satisfy continuity requirements at the spherical core surface. These orbitals are referred to as segmented orbitals. The convergence toward the exact energy values in the various approximations is found to be significantly more rapid than that obtained with Slater orbitals or Slater orbitals with non-integral principle quantum numbers as the number of orbitals in the wave function is initially increased. Excellent results are obtained for the spherical molecular puff problem. Comparisons of the results obtained for the higher order approximations as non-spherical terms are included with published energies obtained with other types of orbitals indicate that the superiority of segmented orbitals is maintained. Author (TAB)

N69-37217# Basel Univ. (Switzerland). Inst. of Physics.
**ANALYSIS OF THE SPECTRUM OF THE NITRIC OXIDE MOLECULE Final Scientific Report, 1 Apr. 1966 – 31 Mar. 1969**
Ernst Miescher Apr. 1969 10 p refs
(Contract AF-EOAR-74-65)
(AD-689398; AFCRL-69-0268) Avail: CFSTI CSCL 7/4

The vacuum-ultraviolet absorption spectrum of nitric oxide gas (4 different isotopes) has been photographed with the most powerful existing spectrographs. The infrared and the visible emission spectrum emanating from a discharge through rapidly streaming NO also has been recorded with very large instruments. In the vacuum ultraviolet it was photographed with a 1 m grating. Comprehensive rotational analyses of the many band structures observed on the plates have been carried out. The result of the investigation is the knowledge of the excited states of the NO molecule exceeding the present knowledge for any other molecule as far as completeness and theoretical understanding is concerned. Several novel features in band structures could be studied, particularly electronic interactions and extreme l uncoupling. Important molecular constants could be derived with high accuracy. Author (TAB)

N69-37221*# Notre Dame Univ., Ind. Dept. of Chemistry.
**EXPLORATORY POLYMER SYNTHESIS Quarterly Status Report, 1 May – 31 Jul. 1969**
G. F. D'Alelio 31 Jul. 1969 11 p
(Grant NGL-15-004-001)
(NASA-CR-105826) Avail: CFSTI CSCL 07C

The entire research effort for the period 1 May 1969 to 31 July 1969 was devoted to the project concerned with polymers of enhanced conductivity and a study of the parameters which contribute to conductivity. Research was directed to the study of prototype or model molecules to assure the accuracy of the specific chemistry when it is applied to the polymeric Schiff bases having pyridine rings in the backbone chain. Accordingly, this status report for the second quarter deals solely with the syntheses and reactions of monomers. Author

N69-37274# Case Western Reserve Univ., Cleveland, Ohio. Div. of Electrical Sciences and Applied Physics.
**STUDY OF EXCITATION PROCESSES IN EMISSION SPECTOGRAPHIC ARCS Final Report, 19 Jun. 1966 – 31 Dec. 1967**
W. Bruce Johnson 17 Jan. 1969 182 p refs
(Contract AF 19(628)-6068)
(AD-689183; AFCRL-69-0116) Avail: CFSTI CSCL 7/4

Studies of the possibilities for spectral excitation using optical techniques were made with application to analytical spectroscopy. Feasibility studies, available laser wavelengths, coincidences with analytical lines, and characteristics of broad band sources are reported. Author (TAB)

N69-37300# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**AN INVESTIGATION OF THERMODIFFUSION IN GASES WITH THE AID OF INFRARED ABSORPTION SPECTRA**
N. A. Borisevich et al 30 Jan. 1969 13 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 5, no. 3, 1966 p 355 – 359
(AD-688094; FTD-HT-23-737-68) Avail: CFSTI CSCL 7/4

Thermodiffusion in binary mixtures of vapor-gas was studied with respect to the integral intensity of absorption bands of elastic vibrations of the NH groups of phthalimide and diphenylamine vapors as it depends on helium and nitrogen concentrations. Depending on the value of the temperature gradient in the phthalimide and nitrogen mixture, attentuation or intensification of absorption is observed, involving a change in the thermodiffusion sign. With no temperature gradient, no foreign gas influence on vibration absorption bands of polyatomic molecules was detected. Author (TAB)

N69-37307# Naval Ammunition Depot, Crane, Ind.
**DIFFERENTIAL THERMAL ANALYSIS THERMOGRAMS OF SODIUM NITRATE DOPED WITH SELECTED CONTAMINANTS**
William L. Ripley 12 May 1969 62 p refs
(AD-689114; NAD-CR-RDTR-143) Avail: CFSTI CSCL 7/4

DTA thermograms of sodium nitrate doped with seventy-three contaminants are presented. Variations in the thermograms due to the contaminants are discussed. Author (TAB)

N69-37314# Naval Research Lab., Washington, D.C. Chemistry Div.
**THE ADSORPTION OF CARBON-14-LABELED STEARIC ACID ON SODA-LIME GLASS Interim Report**
R. L. Patterson, Jr. and L. B. Lockhart, Jr. 23 May 1969 17 p refs
(ARPA Order-878)
(AD-689109; NRL-6901) Avail: CFSTI CSCL 7/4

Procedures have been devised for producing highly compacted monomolecular layers of carbon-14-tagged stearic acid on fire-polished soft (soda-lime) glass through retraction from a nitrobenzene solution. While thermal desorption studies indicated a small quantity of weakly bonded stearic acid on the surface, its rate of removal by other mechaniams (dissolution and isotopic exchange) suggests that only a single type of bonding exists. The rate of loss of stearic acid-1-14C increased with increasing temperature, but the scatter in the data prevented the calculation of the activation energy for desorption. Difficulties in defining the surfaces under investigation rather than weaknesses in the radiochemical technique are the major handicaps in applying radiotracers to the study of surface chemical phenomena. Author (TAB)

N69-37356# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
**FLUORIDE VOLATILITY Conference Proceedings**
J. M. Cleveland, ed. and M. A. Thompson, ed. Oak Ridge, Tenn. AEC 1968 209 p refs Conf. Held at Rocky Flats, Colo., 24 – 25 Jun. 1968
(Conf-680610) Avail: CFSTI

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**N69-37356#** Argonne National Lab., Ill.
**CHEMISTRY OF PLUTONIUM HEXAFLUORIDE**
Martin J. Steindler *In* Dow Chem. Co. Fluoride Volatility 1968 p 2 - 17 ref (See N69-37355 22-06)
Avail: CFSTI

A brief review is given on the preparation and properties of $PuF_6$. The properties discussed include: stability, compatibility, activation energy, crystallization, thermodynamics, chemical reactions, equilibrium at various temperatures, thermal decomposition, and safety aspects. NSA

**N69-37357#** Argonne National Lab., Ill.
**FLUORIDE VOLATILITY PROCESSES: FLUORINATION OF URANIUM AND PLUTONIUM**
N. M. Levitz *In* Dow Chem. Co. Fluoride Volatility 1968 p 18 - 41 refs (See N69-37355 22-06)
Avail: CFSTI

A review is presented on programs conducted that were concerned with reprocessing of nonirradiated simulated fuel materials by the fluoride volatility process. The first program discussed has to do with fully enriched alloy fuels: U-Zircaloy alloy clad with Zircaloy and U-Al alloy clad with Al. Another program was for $UO_2$ dispersed in stainless steel and $UO_2$ dispersed in graphite. Another type is sintered $UO_2$ - $ZrO_2$ clad in Zircaloy similar to that seen in the Pressurized Water Reactor. The main reactions involved in processing these fuels are tabulated and discussed. The basic difference in the handling of these fuels was the head-end step, namely, the chemical step or steps needed to separate the matrix material and to prepare the U for recovery by fluorination. NSA

**N69-37358#** Dow Chemical Co., Golden, Colo. Rocky Flats Div.
**FLUORIDE VOLATILITY LABORATORY STUDIES**
R. S. Marshall *In its* Fluoride Volatility 1968 p 42 - 50 refs (See N69-37355 22-06)
Avail: CFSTI

Laboratory-scale investigations on two plutonium recoverable residues, incinerator ash and slag, are described. To remove Pu from incinerator ash, it was found that the ash had to first be hydrofluorinated at 650°C and then fluorinated. Plutonium removal by this method was 94 wt % and the final residue contained 0.8 wt % Pu, which is slightly over the 0.7 wt % discard limit. Silicon removal from incinerator ash was found to be more difficult than Pu. Plutonium (94 wt %) was removed from slag samples by gradual heating to 550°C during fluorination. Plutonium content in the final residue was only 0.3 wt %. The performance of a packed bed of $PuF_4$ heated to appropriate temperatures for the decomposition of kilogram quantities of $PuF_6$ without introducing impurities into the product is described. Data are given for neutron emission from samples of $PuF_3$, $PuF_4$, and $PuF_6$. NSA

**N69-37359#** Oak Ridge National Lab., Tenn. Metal and Ceramics Div.
**USE OF CHEMICAL VAPOR DEPOSITION TO CONVERT HALIDES TO FISSIONABLE FUEL COMPOUNDS**
W. C. Robinson, Jr., J. I. Federer, and W. R. Martin *In* Dow Chem. Co. Fluoride Volatility 1968 p 51 - 62 refs Sponsored by AEC (See N69-37355 22-06)
Avail: CFSTI

Studies on chemical vapor deposition techniques by ORNL for preparation of ceramic nuclear fuels are reviewed. These include making $UO_2$ powder from $UF_6$ in a flame reactor and demonstration of conversion of $UF_6$ to UN and UC with lithium and appropriate gases, uranium chlorides to $UO_2$, and $PuF_6$ to $PuO_2$. Author (NSA)

**N69-37364#** Goodyear Atomic Corp., Portsmouth, Ohio.
**FLUORINATION OF ALL ENRICHMENTS OF URANIUM OXIDES**
J. G. Crawford *In* Dow Chem. Co. Fluoride Volatility 1968 p 130 - 139 (See N69-37355 22-06)
Avail: CFSTI

The equipment, operating procedures, and system characteristics, for a uranium oxide to uranium hexafluoride conversion facility for processing 20,000 kg of uranium per year are described. Design of the flame-tower and associated subsystems, such as pneumatic unloading and transfer for oxide, feed screw and disperser for the tower, ash removal, filtering, cold trapping, and liquid $UF_6$ loading into cylinders, was dictated by the need for nuclearly safe geometry, so that all enrichments of uranium could be processed, and by the need for maximum protection of personnel from exposure to the uranium materials. Respiratory equipment is not required since the parts of the process, which are apt to allow release of airborne material, are additionally enclosed by glove boxes. Author (NSA)

**N69-37365#** Argonne National Lab., Ill.
**PROCESS CHEMISTRY OF NEPTUNIUM HEXAFLUORIDE**
L. E. Trevorrow *In* Dow Chem. Co. Fluoride Volatility 1968 p 140 - 160 refs (See N69-37355 22-06)
Avail: CFSTI

The chemistry of $NpF_6$ under conditions related to operations that might be carried out in fluoride volatility processes for recovery of fissionable materials is discussed. This includes fluorination of Np(IV) compounds, reactions of $NpF_6$ with bromine, separation of $NpF_6$ - $PuF_6$ mixtures by thermal decomposition, reactions of $NpF_6$ with $MgF_2$, reactions of $NpF_6$ with NaF, structural symmetry of $3NaF \cdot NpF_5$, and use of $NpF_6$ reactions with NaF for $PuF_6$ - $NpF_6$ and $UF_6$ - $NpF_6$ separations. NSA

**N69-37367#** Argonne National Lab., Ill.
**CONTAINMENT OF PLUTONIUM HEXAFLUORIDE**
R. W. Kessie *In* Dow Chem. Co. Fluoride Volatility 1968 p 166 - 184 refs (See N69-37355 22-06)
Avail: CFSTI

Studies on the containment of $PuF_6$ include hydrolysis of $PuF_6$ on glass in the presence of moisture, and the burst release of $PuF_6$. A rate equation was obtained for the hydrolysis of $PuF_6$ using a packed bed of 3.2 mm-OD spherical glass balls. Small-scale equipment was designed to study the effects of sudden releases of pure $PuF_6$ into air containing moisture over the range typical of the atmosphere and under conditions similar to those in glove boxes currently used for work on $PuF_6$. The results indicated that the penetration times the square of the weight of $PuF_6$ released ($W_0$) would be expected to correlate the effects if both agglomeration and loading were significant. Studies were also made on basic processes in filtration using numerical relaxation techniques. NSA

**N69-37387#** National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
**ACTIVATION ANALYSIS SECTION: SUMMARY OF ACTIVITIES, JULY 1967 - JUNE 1968**
Philip D. LaFleur, ed. Mar. 1969 110 p refs
(NBS-TN-458) Avail: SOD, $1.00

The facilities used by LINAC and neutron generator groups are described and installations are proposed for four new irradiation

terminals; a new pneumatic transfer system is also outlined. A 2.5-mA neutron generator was installed with its shield, pneumatic, and director assemblies modified. Emphasis was placed on the development of group radiochemical separations of SRM steel and high purity zinc samples. The self-absorption effects of the matrix on irradiation photons were studied and calculations of sensitivities for photon activation analysis were made. Carbon in sulfur, yttrium in rare earth oxides and oxygen in sodium were determined by photon activation. The extraction of metals by bis(2-ethylhexyl) orthophosphoric acid was studied, and distribution coefficients are given for many of the transition metals. The results indicate enhanced applicability of this reagent for radiochemical separations. Updated keys for computer literature searching and a sample output are included. Author

**N69-37416*#** Stanford Research Inst., Menlo Park, Calif.
**INVESTIGATION OF REACTIVITY OF LAUNCH VEHICLE MATERIALS WITH LIQUID OXYGEN Final Report, 22 Apr. 1968 – 18 Apr. 1969**
Theodore Mill, David L. Chamberlain, Roger S. Stringham, Norman A. Kirshen, and Katherine C. Irwin 16 May 1969 66 p refs
(Contract NAS8-21316; SRI Proj. PRU-7228)
(NASA-CR-102246) Avail: CFSTI CSCL 07C

The impact sensitivity of organic compounds in liquid oxygen was studied to define the ignition mechanism in LOX and to establish the relationship between sensitivity and chemical and physical properties. A modified ABMA drop-weight tester was used to measure the impact sensitivity. For 18 of the 24 compounds tested, a positive correlation was found to exist between the relative sensitivity and flash point. Five other compounds, in two groups, displayed a correlation between sensitivity and chemical reactivity in autoxidation. The relative reactivity of t-butoxy and t-butyl peroxy radicals toward a variety of organic compounds at 50° and 100°C was examined. A good correlation was found between relative reactivity of both radicals toward five hydrocarbons. The correlation for four aliphatic derivatives was less good. No correlation was found between reactivity in oxidation and impact sensitivity for the aliphatic compounds tested. Author

**N69-37448#** Naval Ordnance Lab., White Oak, Md.
**VAPOR PRESSURES AND HEATS OF SUBLIMATION OF SOME HIGH MELTING-ORGANIC EXPLOSIVES**
Jerome M. Rosen and Charles Dickinson 16 Apr. 1969 27 p refs
(AD-689112; NOLTR-69-67) Avail: CFSTI CSCL 19/1

The Langmuir method was used to determine the vapor pressures and heats of sublimation of several high melting organic explosives. The temperatures at which each compound would have a vapor pressure of 10 to the minus seven torr are: (1) cyclotrimethylene trinitramine (RDX), 48.0C; (2) cyclotetramethylene tetranitramine, beta' polymorph, 121.9C; (3) 2,4,6-trinitroaniline (TNA), 44.0C; (4) 1,3-diamino-2,4,6-trinitrobenzene, form I polymorph, (DATB-I), 79.8C; (5) 1,3,5-triamino-2,4,6-trinitrobenzene (TATB), 131.4C; (6) 2,2',4,4',6,6'-hexanitrostilbene (HNS), 170.6C. Within a series those compounds which form the strongest intermolecular hydrogen-bonds have the highest heats of sublimation. Author (TAB)

**N69-37472#** Centre National de la Recherche Scientifique, Bellevue (France). Lab. des Hautes Pressions.
**SURVEY OF THERMODYNAMIC PROPERTIES OF CARBON DIOXIDE [REVUE DES PROPRIETES THERMODYNAMIQUES DU GAZ CARBONIQUE]**
B. Lenoindre and P. Bury 1968 79 p refs In FRENCH
Avail: CFSTI

A bibliographical survey of the thermodynamic properties of carbon dioxide has been carried out, limited to liquid and gas phases in the temperature range 0 to 1000X19C and pressure range 1 to 600 bars. ESRO

**N69-37487#** National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
**ACTIVATION ANALYSIS: A BIBLIOGRAPHY, PART 1**
G. J. Lutz (ed.), R. J. Boreni (ed.), R. S. Maddock (ed.), and W. W. Meinke (ed.) Sep. 1968 522 p refs
(NBS-TN-467-PT-1) Avail: SOD, $8.50 Per Set of 2 Volumes, Sold in Sets Only

References to activation analysis in the open literature are published from a computer readout. The first part of the two-part series contains references numbered according to their accession to the system. The second part contains an author index and three additional indices for element determined, matrix analyzed, and technique used. The two parts, when used together, permit a literature search defined by the three indices. Part 1 will be updated periodically by addenda containing new references while Part 2 will be periodically revised and replaced by new pages which include cross references to the new accessions. Author

**N69-37488#** National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
**ACTIVATION ANALYSIS, A BIBLIOGRAPHY. PART 2: APPENDICES**
G. J. Lutz, (ed.), R. J. Boreni (ed.), R. S. Maddock (ed.), and W. W. Meinke Sep. 1968 203 p refs
(NBS-TN-467-PT-2) Avail: SOD, $6.50 per set of 2 Volumes, Sold in Sets Only

References to activation analysis in the open literature are published from a computer readout. The first part of the two-part series contains references numbered according to their accession to the system. The second part contains an author index and three additional indices for element determined, matrix analyzed, and technique used. The two parts, when used together, permit a literature search defined by the three indices. Part 1 will be updated periodically by addenda containing new references while Part 2 will be periodically revised and replaced by new pages which include cross references to the new accessions. Author

**N69-37537** National Lending Library for Science and Technology, Boston Spa (England).
**GRAVITATIONAL FLOW MECHANISM OF COHESIVE MATERIALS AND HOPPER DESIGN**
Kunio Shinohara et al Jul. 1968 12 p refs Transl. into ENGLISH from Kagaku Kogaku (Tokyo), v 31, no. 3, 1967 p 287 – 292
(NLL-RTS-5128) Avail: Natl. Lending Library, Boston Spa, Engl.: 17s 6d

Hoppers and bins were used to store and feed powders and granular solids in many kinds of processes. When the material treated is a cohesive powder, the container was frequently blocked inside due to the cohesiveness and adhesiveness of the powder material. This was an obstacle to the continuity of the process. In the hopper design, a number of characteristics, such as reliability of outflow, capacity, rate of discharge, time of stay, amalgamation, segregation, wear, etc., were considered. Author

**N69-37543#** Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Service.
**EFFECT OF AROMATIC AMINES CURING ON THE DIELECTRIC CHARACTERISTICS OF EPOXY RESINS [ZAVISIMOST DIELEKTRICHESKIKH SVOISTV EPOKSIDNYKH SMOL OT STEPENI OTVERZHDENIIA AROMATICHESKIMI AMINAMI]**
N. V. Mitroshichev 1968 8 p refs Transl. into ENGLISH from Plasticheskie Massy (Leningrad), v. 1, 1968 p 44 – 46 *its* Ref. 700
Avail: CFSTI

Moulding compositions based on partially cured with aromatic amines epoxy resins possess good adhesive, physico-mechanical and dielectric properties. One moulding composition is used for pressing ground heat-resistant mica condensers operating at temperatures up to 150°C, and is recommended for the shielding of

ceramic condensers, resistors, and other radiotechnical equipment. The properties of epoxy resins, and of the compositions based on them, are directly dependent on the degree of curing with aromatic amines, i.e. on the ratio of the number of epoxy groups bound with the curing agent to their total content in the resin. The higher the degree of curing of an epoxy resin, the higher its heat-resistance and physico-mechanical and dielectric properties. In order to elucidate the nature of this relationship and to evaluate the optimum ratio of resin to curing agent, tests were carried out on ED-5 and ED-6 epoxy resins (mol. wt. 402 and 491) containing 21.4% and 17.5% epoxy groups, respectively. Author

**N69-37544#** Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Services.
**SOME PECULIARITIES OF THE MANIFESTATION OF THE INTERFERENCE OF ELEMENTS IN SPECTRAL ANALYSIS [NEKOTORYE OSOBENNOSTI PROIAVLENIIA VZAIMNYKH VLIIANII ELEMENTON PRI SPEKTRALNOM ANALIZE]**
V. S. Burakow et al. 1968 19 p refs Transl. into ENGLISH from "Emissionsspektroskopie" Berlin, Akad.-Verlag, 1964 p 237–248 *Its* Ref. 699
Avail: CFSTI

This study deals with the laws governing the behaviour of the electrode materials depending on the electrical operating conditions in the light source and the chemical composition of copper-based alloys. From the results obtained, practical recommendations have been worked out for diminishing the reciprocal interference of elements, or utilizing such interference for greater accuracy of spectral analysis. Author

**N69-37551#** Oak Ridge National Lab., Tenn.
**CHEMICAL TECHNOLOGY DIVISION Annual Progress Report, Period Ending 31 May 1968**
Sep. 1968 301 p refs
(Contract W-7405-ENG-26)
(ORNL-4272) Avail: CFSTI

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**N69-37558#** Oak Ridge National Lab., Tenn.
**DEVELOPMENT OF THE THORIUM FUEL CYCLE**
*In its* Chem. Technol. Div. Sep. 1968 p 129–141 refs (See N69-37551 22-06)
Avail: CFSTI

An engineering-scale test of the amine extraction process demonstrated the production of thorium oxide-uranium oxide hydrosols with suitable microsphere forming properties. A batch of 1.5 M hydrosol, with an $NO_3^-$/total metal mole ratio of 0.11 and a Th/U atom ratio of 3, was formed into microspheres. The hydrosol was produced at a rate that is equivalent to 1 kg of oxide per hour. Engineering studies of the amine extraction process were extended to include high-specific-alpha materials, that is, $^{233}U$ and $^{238}Pu$; an alpha-contained amine extraction system has been designed that will permit the preparation of concentrated hydrosols containing fissionable isotopes at a rate of 1 kg/day. A simplified diagram of the equipment for producing concentrated hydrosols is shown and the construction of a thorium reactor uranium storage tank is described. Author

**N69-37559#** Oak Ridge National Lab., Tenn.
**SOL-GEL PROCESSES FOR THE URANIUM FUEL CYCLE**
*In its* Chem. Technol. Div. Sep. 1968 p 142–160 refs (See N69-37551 22-06)
Avail: CFSTI

The preparation of $UO_2$ sols by the solvent extraction method has been successfully scaled up and operated continuously in engineering experiments. Forty runs, each producing about 2 kg of $UO_2$ in the form of a dilute (about 0.2 *M*) sol, have been made. Studied were the three operating parameters that affect sol properties: nitrate-to-uranium mole ratio during digestion, digestion temperature, and method for preparing the initial U(IV) solution. The basic method for preparing $UO_2$ sol by solvent extraction consists in extracting nitrate from an aqueous solution of U(IV) nitrate-formate with a long-chain amine dissolved in a paraffin. Digestion of the resulting nitrate-deficient solution produces the $UO_2$ sol. Final nitrate adjustment is obtained in subsequent extractions. The amine, which is regenerated by contact with sodium carbonate, is recycled. Author

**N69-37560#** Oak Ridge National Lab., Tenn.
**SOL-GEL PROCESSES FOR ISOTOPIC HEAT SOURCES**
*In its* Chem Technol. Div. Sep. 1968 p 161–173 refs (See N69-37551 22-06)
Avail: CFSTI

Laboratory scale studies were used to develop a procedure for preparing dense $^{238}$plutonium oxide microspheres by the sol-gel process and the successful preparation of $^{238}$plutonium sols and microspheres on a pilot plant scale. Effects of increased radiolysis and of self-heating on the process showed that $^{238}$plutonium sols can be made from 10 g of $^{238}$plutonium by incorporating an aging step into the flow sheet following the precipitation step. A plutonium sol-gel pilot plant was built and used to prepare $^{238}$plutonium microspheres; preliminary runs with $^{238}$plutonium were unsatisfactory. G.G.

**N69-37561#** Oak Ridge National Lab., Tenn.
**SEPARATIONS CHEMISTRY RESEARCH**
*In its* Chem. Technol. Div. Sep. 1968 p 174–186 refs (See N69-37551 22-06)
Avail: CFSTI

Continuing work in the extraction of metal sulfates and nitrates by amines is discussed, and data from several experiments are given. Less expensive methods of beryllium purification for reactor use are under study, with emphasis on developing a purification process using quaternary ammonium extractants to recover beryllium from dilute carbonate liquors. Due to expanding production of phosphoric acid and the corresponding increase in the total amount of solubilized uranium from the process, studies for an economical process for uranium recovery were conducted with satisfactory results obtained using a synergistic uranium extraction combination of di (2-ethylhexy) phosphoric acid (D2EHPA) plus tri-n-octylphosphine oxide. Analysis of equilibria and mechanisms of extraction is continuing, in addition to investigations of the kinetics of ion extraction by organophosphorus acids. Finally, aggregation and activity coefficients in solvent phases are treated, including techniques for measuring vapor pressure depression, the use of benzil as a reference standard, measurement of aggregation numbers for carboxylate extractants, and the role of water in extractant phases. A.C.R.

**N69-37562#** Oak Ridge National Lab., Tenn.
**CHEMICAL APPLICATIONS OF NUCLEAR EXPLOSIONS**
*In its* Chem. Technol. Div. Sep. 1968 p 187–191 refs (See N69-37551 22-06)
Avail: CFSTI

Results of continuing research in selected areas of the Plowshare Program are reported. Specific studies were conducted on the distribution and possible behavior of radionuclides formed during the recovery of copper from ore deposits and of oil from shales using nuclear explosives. Various methods were investigated for producing ruthenium-free copper products, since it was determined that $Ru^{106}$ is probably the only radioisotope of importance with respect to radioactive contamination of the cement copper. Results of scoping tests indicated that the contamination of shale oil by fission products should not be a serious obstacle to using a nuclear device to break the shale. The problem of contamination by tritium (from a fusion device) appears to be more serious, however, since the distilled products also contained the isotope. It apparently is incorporated into the hydrocarbons of the shale diromg extpsire to tritiated water vapor. A.C.R.

**N69-37563#** Oak Ridge National Lab., Tenn.
**BIOCHEMICAL SEPARATIONS**
*In its* Chem. Technol. Div. Sep. 1968 p 192–217 refs (See N69-37551 22-06)
Avail: CFSTI

Macromolecular separation research into the development of reversed-phase chromatography systems for transfer ribonucleic acid (RNA) separations is reported. Particular emphasis was placed on the separation of E. coli transfer RNA's and related problems; two new chromatography systems were developed during a systematic evaluation of new quaternary ammonium salts for RNA separation. Engineering-scale procedures for separating large (gram) quantities of relatively pure transfer acids were also studied, as well as isolation of purified transfer RNA's and solvent extraction techniques. The behavior of the transfer acids on polyacrylamide gel columns and the mechanism of RNA separation by gel-permeation chromatography were investigated. As part of a project to develop rapid, accurate, and highly automated laboratory procedures for body fluid analysis, two systems were developed to determine the low molecular weight constituents of body fluids: (1) an analyzer for ultraviolet absorbing constituents; and (2) an analyzer for carbohydrates. A.C.R.

**N69-37564#** Oak Ridge National Lab., Tenn.
**IRRADIATION EFFECTS ON HETEROGENEOUS SYSTEMS**
*In its* Chem. Technol. Div. Sep. 1968 p 218 (See N69-37551 22-06)
Avail: CFSTI

Initial experiments on the radiolysis of adsorbed water using silica gel as the adsorbent were completed, and attention was turned to molecular sieves of various types. Present efforts are aimed at investigating irradiation effects on colloidal systems, using the recently acquired streaming current detector. Author

**N69-37565#** Oak Ridge National Lab., Tenn.
**SPECTROPHOTOMETRIC STUDIES OF SOLUTIONS OF ALPHA-ACTIVE MATERIALS**
*In its* Chem. Technol. Div. Sep. 1968 p 219–220 refs (See N69-37551 22-06)
Avail: CFSTI

Studies of the chemical properties of aqueous solutions concentrated principally on the uranyl ion and the correlation of its spectra with those of the penta- and hexavalent trans-uranium elements. A specially modified spectrophotometer system was built and installed for studying the more highly alpha-active actinides so as to provide safe containment for the materials and to operate at temperatures up to the critical point of water and at pressures up to 10,000 psi. Author

**N69-37566#** Oak Ridge National Lab., Tenn.
**CHEMICAL ENGINEERING RESEARCH**
*In its* Chem. Technol. Div. Sep. 1968 p 221–224 refs (See N69-37551 22-06)
Avail: CFSTI

A stacked-clone contactor, a multistaged, countercurrent, solvent extraction device featuring a high flow capacity, a very short residence time per stage, and high stage efficiencies was developed. The ultimate objective is to apply this device to radiochemical systems that demand minimal solvent radiation exposure. At this time the contactor holds promise of being highly suitable for this application. Other desirable features include rapid response and rapid recovery from process perturbations. Its ability to attain steady-state operation from startup in a matter of a few minutes will undoubtedly bring about application in short or varied processing campaigns, nuclear or nonnuclear, where small batches of feed must be processed quickly and efficiently at near-steady-state conditions. Its very high throughput-to-internal-volume ratio allows extractor-scrubbing-stripping to proceed with a very low solvent inventory. Author

**N69-37568#** Oak Ridge National Lab., Tenn.
**PREPARATION AND PROPERTIES OF ACTINIDE OXIDES**
*In its* Chem. Technol. Div. Sep. 1968 p 236–242 refs (See N69-37551 22-06)
Avail: CFSTI

Techniques are studied for improving the microstructure, surface-chemical, and colloid-chemical properties which control the behavior of metal hydroxides and oxides in sol-gel processes. Electrophoretic mobility and streaming current measurements on chloride-and nitrate stabilized uranic sols are evaluated for their dependance on concentration, voltage gradients, and oxidation potentials. Investigations in preparing cermets by sol-gel processes continued with the formation of an iron-alumina cermet. Gases evolving from a heated uranic gel were analyzed by gas chromatography, and several comparative studies on lanthanide and actinide sols were started. G.G.

**N69-37569#** Oak Ridge National Lab., Tenn.
**CHEMISTRY OF CARBIDES AND NITRIDES**
*In its* Chem. Technol. Div. Sep. 1968 p 243–248 refs (See N69-37551 22-06)
Avail: CFSTI

Results are reported for reactions of: (1) uranium carbides with sodium hydroxide solutions; (2) uranium mononitride and thorium monocarbide with nitric acid; and (3) uranium monocarbide and thorium monocarbide with ammonium fluoride solutions. A program to determine the chemical properties of uranium carbonitride was initiated. Since the uranium carbide specimens used in the chemical studies had already been carefully characterized by chemical, X-ray

diffraction, and metallographic techniques, the microstructures were correlated with their compositions and heat treatments. Optical photomicrographs, at magnifications of 250 and 1000x, of 78 different arc-cast and heat-treated uranium carbide specimens, together with their compositions and heat treatments, are discussed. The phases present were identified by X-ray diffraction analysis of the specimens at room temperature and, in many instances, were further confirmed by determining products of hydrolysis. Specimens were also analyzed for total uranium, total carbon, free carbon, oxygen, nitrogen, and tungsten. Author

**N69-37608#** Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Services.
**RELATION BETWEEN THE STRUCTURE AND THE DIELECTRIC PROPERTIES OF HIGH POLYMERS [RELAXIONE TRA STRUTTURA E PROPRIETA DIELETTRICHE DEGLI ALTI POLIMERI]**
Mario Pegoraro 1968 16 p refs Transl. into ENGLISH from Materie Plastiche ed Elastomerie (Milan), v. 31, no. 8, 1965 p 803–809 Presented at the 16th European Congr. on Plastics, Plast 64, Milan, 20–23 Sep. 1964 *Its* Ref. 729
Avail: CFSTI

The relative dielectric constant and the loss factor of the substance concerned as a function of the temperature and the frequency are investigated. Shown are the principle correlations between the measured electrical magnitudes and the physico-chemical structure of the high polymers of which dielectrics are composed. Results indicate it is now possible to estimate polar or apolar polymers and to calculate the energy of activation of the various processes involved and relate them to both the chemical nature and structure of the polymers involved. Author

**N69-37617** National Lending Library for Science and Technology, Boston Spa (England).
**ELECTROCHEMISTRY [ELEKTROKHIMIYA]**
A. N. Frumkin Jul. 1969 55 p refs Transl. into ENGLISH from Razv. Fiz. Khim., SSSR, 1917–1967 (Moscow), 1967 p 149–176 (NLL-RTS-5163) Avail: Natl. Lending Library, Boston Spa, Engl.: 40s

A survey of the advancing development of Soviet electrochemical science is presented in both theoretical work and the solution of applied problems. Two determinants of significance are noted: (1) the diversion of attention from studies of the theoretical properties of systems to process mechanisms studies, and (2) simultaneously with the development of theoretical electrochemistry, connections were made with applications of the new knowledge as in problem-solving for the fuel cell. Major fields of study related to the ongoing development are electrochemical kinetics, the electrical double layer, semiconductor materials in radioelectronics and as electrode materials, and applied electrochemistry problems involving related investigations in the fields of chemistry, physics, and electronics. Discussion proceeds along historical lines with major investigators and their significant findings reported in detail. M.H.E.

**N69-37618#** Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Services.
**THE KINETICS OF THE DEPOSITION OF FINE LAYERS OF LEAD SULPHIDE AT THE Pb-SOLUTION INTERFACE [KINETIKA OSAZHDENIIA TONKIKH PLENOK SUL-FIDA SVINTSA NA GRANITSE RAZDELA FAZ Pb-S-RASTVOR]**
A. B. Lundin et al 1968 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. SSSR, Khim. i Khim. Tekhnol. (Moscow), v. 10, no. 4, 1967 p 408–411 *Its* Ref. 701
Avail: CFSTI

The kinetics of the growth of PbS layers at the PbS-solution interface were studied. It was shown that formation of lead sulphide in the course of a reaction with thiourea and alkali occurs as a heterogenous catalytic process where the PbS surface acts as catalyst. It was shown that PbS is formed in several stages with varying reaction rates. The limiting stage for the overall chemical conversion rate is that of dissociation of thiourea in alkaline medium on the catalyst surface of PbS. The conclusions regarding the mechanism of the chemical reaction would probably be applicable also to the other sulphide formation processes occurring in the course of the reaction of thiourea with metal ions in alkaline media. Author

**N69-37884#** Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Services.
**APPLICATION OF PARTIAL DEDOUBLING IN HOMOGENEOUS PHASE. PART 6: DETERMINATION OF THE ABSOLUTE CONFIGURATION OF THE DEXTROROTATORY OR LEVOROTATORY CONSTITUENTS OF A RACEMIC ALCOHOL (OR A RACEMIC AMINE) [APPLICATION DUE DEDOUBLEMENT PARTIEL EN PHASE HOMOGENE. PART 6: DETERMINATION DE LA CONFIGURATION ABSOLUE DES CONSTITUANTS DEXTROGYRE OU LEVOGYRE D'UN ALCOOL RACEMIQUE (OU D'UNE AMINE RACEMIQUE)]**
Robert Weidmann 1968 25 p refs Transl. into ENGLISH from Bull. Soc. Chim. France (Paris), no. 1, 1967 p 117–124 *Its* No. 21, Ref. 723
Avail: CFSTI

A method that makes possible the determination of R or S configurations of the constituents of a racemic alcohol is described; it involves the esterification of the alcohol in pyridine, in the absence of optically active α-phenylbutyric anhydride. The sign of the nonesterified alcohol isolated from the mixture permits a determination of its configuration. Author

**N69-37885#** Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Service.
**DETERMINATION OF CONFIGURATIONS BY PARTIAL DEDOUBLING. PART 7: DETAILS CONCERNING THE CONCEPT OF CROWDING [DETERMINATION DES CONFIGURATIONS PAR DEDOUBLEMENT PARTIEL. PART 7: PRECISIONS SUR LA NOTION D'ENCOMBREMENT]**
Andree Marquet et al 1968 14 p refs Transl. into ENGLISH from Bull. Soc. Chim. France (Paris), no. 1, 1967 p 124–128 *Its* No. 22, Ref. 724
Avail: CFSTI

The method of determining the configurations of secondary alcohols by partial dedoubling made it possible to assess the dissymmetry of the crowding of the hydroxyl. Apparent anomalies which were observed occasionally could explain by an examination of spatial models. Author

**N69-37899*#** IIT Research Inst., Chicago, Ill. Technology Center.
**FEASIBILITY STUDY OF CLATHRATES FOR CARBON DIOXIDE REMOVAL, 13 SEPTEMBER 1968–12 MARCH 1969**
K. S. Rajan Mar. 1969 38 p
(Contract NAS1-8292)
(NASA-CR-66799) Avail: CFSTI CSCL 07D

The use of clathration phenomenan for the regenerative removal of carbon dioxide from space cabin environments was studied. Selected clathrate-host compounds with and without the presence of promoter compounds were examined for reversible clathration of carbon dioxide. The feed gas consisted of $CO_2$-air mixtures having $CO_2$ partial pressures of 4 mm and 8 mm mercury (0.5 and 1.0%) at a total pressure of 1 atmosphere. The methods of gas–solid interactions and liquid-phase crystallizations were employed in the clathration studies. Experiments were conducted to determine the dynamic adsorption and desorption (occlusion and exclusion) characteristics of selected clathrates. Thermal regeneration of the clathrate was investigated at 80°C (176°F) and 97°C (206.6°F). Author

**N69-37710#** Bureau of Mines, Morgantown, W.Va. Petroleum Research Lab.

**LABORATORY OIL-RECOVERY TESTS WITH ULTRASONICALLY FORMED EMULSIONS**
Charles A. Komar and H. A. W. Moore Sep. 1969 18 p refs
(BM-RI-7296) Avail: Issuing Activity

Oil displacement tests were conducted in the laboratory with three water-in-oil and five oil-in-water emulsions that were created with ultrasonic energy at a frequency of 20 kHz and an acoustic intensity of approximately 100 watts per $cm^2$. Emulsions of either crude oil or kerosine, brine, and 1/2 to 2 percent emulsifier were formed during 30 seconds of acoustic irradiation. Results indicate that ultrasonic energy induces greater and more uniform dispersions of one liquid in another in the presence of small amounts of chemical emulsifiers. When the emulsions were injected as a buffer slug before waterflooding, recovery of the oil-in-place was 8 to 22 percent greater than with conventional waterflooding in the test specimens, regardless of the continuous phase (oil or brine). The emulsions do not appear to be applicable to the Appalachian area; however, because the oilfields are too tight, the clays in the formation remove the emulsifier from the displacing fluid, and not enough additional oil is produced, compared with recovery using conventional waterflooding, to warrant the increased operating costs. Author

**N69-37732*#** Florida Univ., Gainesville. Dept. of Chemical Engineering.
**SYNTHESIS OF ELASTOMERS FOR USE WITH LIQUID FLUORINE Quarterly Report, 1 Apr. – 30 Jun. 1969**
Henry C. Brown and A. R. Mukherjee 30 Jun. 1969 20 p
(Contract NSR-10-005-047)
(NASA-CR-105744; QR-9) Avail: CFSTI CSCL 07C

The synthesis of elastomeric polymers that will be resistant to the strong oxidizing effect of fluorine, oxygen difluoride, nitrogen tetroxide and similar agents is investigated, with the additional requirement that the material should be flexible at cryogenic temperatures. Two perfluorodihydroxamic acids, namely succinic and adipic, were prepared and purified. Like perfluorosebacic hydroxamic acid, the perfluoroadipo hydroxamic acid, on heating with phosphorous pentoxide, yielded a mixture of isocyanate and acid or anhydride. The analysis of crude perfluorosebacodiisocyanate (obtained as distillate during distillation of the liquid product) by gas chromatogram showed three ingredients. The major one on isolation turned to a white solid, by reaction with moisture and had the same C:N ratio as that of $(CF_2)_8(NCO)_2$. Reaction of perfluorobutyroisocyanate and ammonia was studied under various conditions. Author

**N69-37743#** Atomic Energy Commission Research Establishment, Risö (Denmark). Agricultural Research Dept.
**FREE AMINO ACIDS IN CRUCIFERAE AND RESEDACEAE**
P. Olesen Larsen (Ph.d. Thesis-Copenhagen Univ., 11 Dec. 1968) (Roy. Vet. and Agr. Coll.) Jan. 1969 153 p refs
(RISO-139) Avail: CFSTI

A series of investigations concerning free amino acids in the plant families cruciferae and resedaceae is described, particularly the methods used for qualitative analysis and isolation and structure determination of amino acids. Results of these concerning 28 species of cruciferae and 14 species of resedaceae are summarized. A survey is given on the γ-glutamyl derivatives identified in species of cruciferae. The four naturally occurring meta-carboxy-substituted aromatic amino acids are discussed and a review of present knowledge of the biogenesis of aromatic amino acids in microorganisms, animals, and higher plants is made. ESRO

**N69-37778#** Dayton Univ., Ohio. Research Inst.
**THEORETICAL CALCULATION OF THE ENERGY LEVELS OF Gd 3 IN CALCIUM FLUORIDE Technical Report, 1 Jan. 1967 – 30 Nov. 1968**
J. M. O'Hare and V. L. Donlon (AFML) Wright-Patterson AFB, Ohio AFML Apr. 1969 36 p refs
(Contract AF 33(615)-3793)
(AD-688970; UDRI-TR-68-05; AFML-TR-69-72) Avail: CFSTI CSCL 7/4

The free ion wave functions of the f7 states of Gd(3+) were calculated using the parameters of Judd, Crosswhite, and Crosswhite, wherein spin-spin and spin-other-orbit interactions are taken into account. These free ion states were used to calculate the energy levels of Gd(3+) in the cubic crystal field site of $CaF_2$. Two calculations were done. In the first, only the 18M(J) components of the free ion 8P states were used as a basis. This calculation gave a mean error of 8/cm between calculated and experimental levels. In the second calculation, the 134M(J) components of the free ion 8S, 6P, 6I, and 6D levels were used as a basis. This calculation gives the correct ordering of the ground state representations and an overall ground state splitting about one half of the observed splitting. Means of further improving the ground state fit are discussed. Author (TAB)

**N69-37792#** Aerospace Corp., El Segundo, Calif. Lab. Operations.
**MAIN, A PROGRAM FOR COMPUTING FREQUENCIES AND RELATIVE INTENSITIES FOR ALLOWED TRANSITIONS OF AN ASYMMETRIC ROTOR MOLECULE, APRIL 1968 – FEBRUARY 1969**
Richard T. Hall 15 Apr. 1969 98 p refs
(Contract F04701-68-C-0200)
(AD-689747; TR-0200(9250-01)-6; SAMSO-TR-69-186) Avail: CFSTI CSCL 7/4

A computer program is described which calculates the frequencies and relative intensities of allowed rotational or vibrational-rotational transitions of an asymmetric rotor molecule. The inputs to the program are the energy levels and asymmetry parameters of the molecule. Author (TAB)

**N69-37824#** GCA Technology Div., GCA Corp., Bedford, Mass.
**RECOMBINATION RATES OF H(PLUS) AND H(MINUS) Final Report, 1 Oct. 1968 – 28 Nov. 1968**
G. A. Victor, A. Dalgarno, T. G. Webb, and J. C. Browne Apr. 1969 18 p refs
(Contract AF 19(628)-5862)
(AD-689421; GCA-TR-69-1-A; AFCRL-69-0191) Avail: CFSTI CSCL 7/4

Various approximate theoretical calculations of the temperature dependence of the rate coefficient of the mutual neutralization reaction H(+) + H(-) to H + H are presented. Their accuracy is assessed by comparison at 500K and at 1000K with the results of a multi-channel close-coupling impact parameter calculation. Author (TAB)

**N69-37831#** Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Service.
**CURING OF LOW MOLECULAR EPOXY RESINS WITH AROMATIC DIAMINES [VYTVRZOVANI NIZKOMOLEKULARNICH EPOXIDOVYCH PRYSKYRIC AROMATICKYMI DIAMINY]**
Bruno Schreiber 1968 22 p refs Transl. into ENGLISH from Chem. Prumysl (Prague), v. 15/40, no. 8, 1965 p 488–494
/ts Ref. 704
Avail: CFSTI

Epoxy resins cured with aromatic diamines have very good technical properties and are therefore useful as binders for laminates and thermosetting pressing materials. Compared are the three commonly used curing agents, m-phenylene diamine, p,p'-diamino diphenyl methane and p,p'-diamino diphenyl sulphone for optimum ratio of low-molecular epoxy resin to each of the curing agents from the point of view of the properties of the cured binders. Recommended is the temperature range for their processing and the use of eutectic mixtures with possible conversion of binder to a solid nonadhesive state. The possibility of regulating the course of the curing reaction by means of catalysts or retarders, and of

following up the reaction rate by means of a simple method consisting in the plotting of the so-called gel curves is pointed out. Author

N69-37832*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

**MASS EXCHANGE DURING CONDENSATION OF CESIUM VAPOR FROM A MOVING MIXTURE WITH ARGON [MASOOBMEN PRI KONDENSATSII PAROV TSEZIYA IZ DVIZHUSHCHEYSYA SMESI S ARGONOM]**

I. L. Mostinskiy et al. Washington NASA Sep. 1969 5 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur, Akad. Nauk SSSR (Moscow), v. 7, no. 2, 1969 p 378–380
(Contract NASw-1692)
(NASA-TT-F-12394) Avail: CFSTI CSCL 07C

Determined are experimental data for mass exchange during condensation of cesium vapor in a moving mixture with argon by analogy with heat exchange. Author

N69-37848# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

**THE $\Gamma$ RADIOLYSIS AT ROOM TEMPERATURE OF LIQUID DEAERATED ISOPROPANOL [RADIOLYSE $\Gamma$ A TEMPERATURE AMBIANTE DE L'ISOPROPANOL LIQUIDE DESAERE]**

Lucien Gilles (Ph.D. Thesis--Paris Univ., 28 Feb. 1969) Jun. 1969 107 p refs In FRENCH; ENGLISH summary
(CEA-R-3800) Avail: CFSTI

The main products formed in the room temperature $\gamma$ radiolysis of liquid isopropanol, and their respective yields, are: hydrogen 3.8, methane 1.6, acetone 3.4, acetaldehyde 1.1, and pinacol 0.3. These results give a material balance in good agreement with the formula of isopropanol and lead to a value for the yield of decomposition of 5.3. The absence of butanediol 2.3 shows that the acetaldehyde cannot come from the dismutation of hydroxyethyl radicals. The variations of the hydrogen yield in the neutral medium with the concentration of added electron scavengers may be explained in terms of the model proposed by Freeman and Fayadh which supposes the existence of spurs. The yield of solvated electrons diffusing into the bulk of the solution and also the ratios of rate constants for the reactions of the scavengers with the electrons may likewise be obtained on the basis of this model. Certain effects not foreseen by this model may result from the capture of electrons solvated or not whose mode of disappearance in pure alcohol remains unknown. One may distinguish a yield of excited molecules of at least 2, of which 80 per cent lead to the production of molecular hydrogen and 20 per cent to that of molecular methane, and an ionization yield of 2.2. The discussion of the various mechanisms which may lead to the formation of the products indicates that these yields may be higher than the values quoted. Author (ESRO)

N69-37851*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

**EXPERIMENTAL DETERMINATION OF THE PRESSURE OF SATURATED LITHIUM VAPOR [EKSPERIMENTALNOYE OPREDELENIYE DAVLENIYA NASYSHCHENNOGO PARA LITIYA]**

V. M. Anisimov et al. Washington NASA Sep. 1969 4 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur (Moscow), v. 7, no. 2, 1969 p 371–372
(Contract NASw-1692)
(NASA-TT-F-12393) Avail: CFSTI CSCL 07C

Measurements of the pressure of saturated lithium vapor were made by the equilibrium static method using zero-membranes applied earlier to other alkali metals. Author

N69-37853*# Techtran Corp., Glen Burnie, Md.

**STUDY OF MASS SPECTROGRAPHIC MICROPROBE ANALYSIS**

N. Yamaguchi et al. Washington NASA Sep. 1969 10 p refs Transl. into ENGLISH from Bunseki Kagaku (Tokyo), v. 18, no. 3, Mar. 1969 p 370–376
(Contract NASw-1965)
(NASA-TT-F-12523) Avail: CFSTI CSCL 07C

Basic conditions of microprobe analysis by a high frequency spark mass spectrograph were studied. When platinum or tungsten wire of a diameter of 200$\mu$ was used as the counter-electrode in relation to analyzed samples, craters on sample surfaces were from 400 to 600$\mu$ in diameter and from 10 to 20$\mu$ deep with $1 \times 10^{-10}$ coulombs exposure and 300$\mu$ in diameter and 2$\mu$ deep with $3 \times 10^{-13}$ coulombs exposure, their sizes differing with pulse repetition frequency and spark voltage. Also, it was possible to detect elements of 0.01% and of more than 1% by the former and latter exposures respectively. Since ion intensity ratios from samples and counter-electrode metal varied with each measurement, in correcting ion intensity from the counter-electrode metal, platinum having a broad isotope abundance ratio was more suitable than tungsten as the counter-electrode. Analytical precision with low alloy steel standard samples had a variation coefficient of from 5% to 17%. Author

N69-37879# Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Service.

**TETRAGONAL MODIFICATION OF CHALCOCITE [O TETRAGONALNOI MODIFIKATSII KHALKOZINA]**

N. R. Serebriansaia 1968 3 p refs Transl. into ENGLISH from Geokhimiia (USSR), v. 7, 1966 p 866–867 *Its* Ref. 744
Avail: CFSTI

A tetragonal modification of copper sulfide was obtained by heating $\beta$-$Cu_2S$ in a nitrogen stream to 900°C for one hour. A tubular furnace was used for the tests which had been calibrated with a platinum-platinum-rhodium thermocouple. After heating the copper sulfide samples, they were examined by X-ray analysis. Debye photographs were obtained by means of filtered copper radiation. The X-ray photographs contained all the lines of the tetragonal form of $Cu_2S$ as well as a small amount of cuprous oxide, probably a result of inadequate furnace sealing. The tetragonal form of the $Cu_2O$ proved fairly stable at room temperature: after eight months the samples were found to be unchanged. When the $\beta$-$Cu_2S$ was heated at a temperature below 500°C, the X-ray photographs contained only the lines of the low-temperature $\gamma$-$Cu_2S$ chalcocite. The $\beta$-$Cu_2S$ samples were also subjected to pressures up to 60 kbar and to temperatures up to 1600°C. It was found that a metastable polymorphic transition of the $\beta$-$Cu_2S$ into the tetragonal form takes place here. Debye photographs showed all the lines to have tetragonal modification. A sharp increase in the resistance of copper sulfide was noted during the pressure tests at the temperature of polymorphous conversion. K.W.

N69-37886# Picatinny Arsenal, Dover, N.J. Feltman Research Labs.

**EQUATION OF STATE OF GASEOUS MIXTURES CONSISTING PRIMARILY OF LIGHT HYDROCARBONS AND NITROGEN**

W. A. Zagoruchenko May 1969 9 p refs Transl. into ENGLISH from Izv. Vyssh. Uchab. Zaved., Neft i Gaz (Baku), v. 8, no. 2, 1965 p 72–74
(AD-688595; PA-TT-160) Avail: CFSTI CSCL 20/13

To provide means for determining the volumetric and caloric characteristics of the mixtures of methane, ethene, and nitrogen found in many gas deposits in the USSR, the author presents the form in which the equations of state for gases and their mixtures are written and gives, in tabular form, values for the constants in the equations of state for ethane, propane, isobutane, n-pentane and nitrogen. Further, it is pointed out that functions for the interaction of various proportions of the various constituent gases must be derived, since mixtures of nitrogen and paraffin hydrocarbons do not form ideal solutions even at moderate pressures. Such interaction data is estimated analogically from thermic data for pairs of the gases under study. A good agreement between calculated and

experimental values is reported. Effects of varying the temperature and the pressure were studied. Author (TAB)

**N69-37901#** National Inst. for Metallurgy, Johannesburg (South Africa).
**DETERMINATION OF TRACE AMOUNTS OF ARSENIC IN URANIUM TETRAFLUORIDE**
R. V. D. Robert, B. G. Russell, and T. W. Steele 19 Jun. 1968 17 p refs
(NIM-354) Avail: AEC Depository Libraries

A method was developed for determination of trace amounts of arsenic in uranium tetrafluoride. The method is based on the extraction of the arsenic as the diethyldithiocarbamate complex and its subsequent evolution as arsine. The arsine is collected in a solution of silver diethyldithiocarbamate dissolved in pyridine and the transmittancy of the colored complex thus formed is measured spectrophotometrically. The coefficient of variation is 3.9% at a concentration of 3 ppM and 2.4% at a concentration of 40 ppM of arsenic. The lower limit of determination is 1 ppM. Author (NSA)

**N69-37910#** Los Alamos Scientific Lab., N. Mex.
**SPECTROCHEMICAL DETERMINATION OF YTTRIUM IN TANTALUM METAL AND TANTALUM-TUNGSTEN ALLOYS**
Oliver R. Simi and Robert T. Phelps 19 May 1969 10 p refs
(Contract W-7405-ENG-36)
(LA-4127) Avail: CFSTI

A spectrochemical method was developed for determining 1 to 100 ppM of yttrium in tantalum metal and tantalum-tungsten alloys. The sample is ignited to oxide and then mixed with an equal weight of graphite powder containing lanthanum as the internal standard. A 15-mg electrode charge is excited by a dc arc in an Ar-$O_2$ atmosphere. The spectrum is photographed with a 3.4-m Ebert-mounting spectrograph having a reciprocal linear dispersion of 2.5 Å/mm. The yttrium concentration is evaluated by photometric measurements of the line pair Y II 3710.30 Å and La II 3725.05 Å. Concentrations of 5 to 40 ppM are determined with 8% relative standard deviation. The presence of 10% tungsten or 500 ppM each of 14 impurity elements has no effect on the yttrium/lanthanum intensity ratio. Preparation of the sample and standards by an alternative technique verified the recommended procedure. Author (NSA)

**N69-37911#** Isotopes, Inc., Palo Alto, Calif. Palo Alto Labs.
**INVESTIGATIONS OF SURFACE PROPERTIES OF GEOLOGIC MATERIALS. PART 1: MEASUREMENT OF APPARENT SURFACE AREAS BY THE VOLUMETRIC, GAS-ADSORPTION METHOD**
C. L. Carnahan, D. C. Castagnola, and M. E. Smith Oct. 1968 56 p refs
(Contract AT(29-2)-1229)
(NVO-1229-99) Avail: CFSTI

Apparatus was constructed for the measurement of low-temperature gas-adsorption isotherms of geologic materials by the static, volumetric method. Adsorbates were nitrogen and argon, and adsorption experiments were conducted at 77°K (−196°C). The samples were granite from the shoal site, rainer melt and chimney rubble, a carbonate rock, and a pumice. The rocks were crushed and separated into six to nine particle-size fractions ranging in particle diameter from less than 62 to 16,000 microns (less than 0.062 to 16 millimeters). Gas-adsorption isotherms were measured both before and after several of the samples were equilibrated with native or simulated native ground water. Author (NSA)

**N69-37913#** Gulf General Atomic, San Diego, Calif.
**CHEMICAL VAPOR DEPOSITION OF TUNGSTEN**
J. Chin and J. Horsley Oct. 1968 15 p refs Presented at IEEC Thermionic Conversion Specialist Conf., Boston, 21 – 4 Oct. 1968
(Contract AT(04-3)-167)
(GA-8772; CONF-681059-1) Avail: CFSTI

A study of process parameters relative to the fluorine content of chemically vapor-deposited tungsten, a key feature in stability of emitters for thermionic application is described. Fluorine contents of tungsten deposits were found to be an inverse function of the deposition temperature and $H_2$:$WF_6$ ratio. Deviations in fluorine content measurements in vapor-deposited tungsten are sometimes larger than proposed allowable fluorine limits. Activation analysis is being evaluated as a method of measuring low fluoride concentrations in tungsten. Principle problems with activation analysis of fluorine are caused by gamma attenuation correction factors and a lack of suitable standards. Author (NSA)

**N69-37914#** Los Alamos Scientific Lab., N. Mex.
**DICARBIDES OF EUROPIUM AND OTHER RARE-EARTH METALS**
N. N. Matiushenko et al [1968] 8 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 13, 1968 p 1083 – 1085 Sponsored by AEC
(LA-4156-TR) Avail: CFSTI

Europium dicarbide is obtained in the $Eu_2O_3$-C system at 1800°K. It has the face-centered cubic cell with a $=0.596_{1\pm1}$ nanometers (nm). The volume of the europium dicarbide is compared with volumes of the well-known rare-earth metal dicarbides. The decrease of 0.006 $nm^3$ from additivity is established for $EuC_2$, $BaC_2$, and $CaC_2$. The volume variation is connected with an electron structure of rare-earth elements. Author (NSA)

**N69-37952#** Sandia Corp., Livermore, Calif. Materials Science Div.
**PREPARATION OF URANIUM FOR ELECTROPLATING WITH NICKEL**
J. W. Dini and P. R. Coronado Oct. 1968 31 p refs Presented at Metal Finishing Conf., London
(Contract AT-(29-1)-789)
(SCL-DC-68-50; CONF-690505) Avail: CFSTI

A process was developed for reliably protecting unalloyed depleted uranium with an adherent, corrosion-resistant electroplated deposit. The key to the process was treatment of the uranium with a metal chloride/nitric acid solution before plating. Solutions containing stannous or nickel chloride yielded results superior to those of solutions containing other metal chlorides. For production purposes, however, the nickel chloride solution – because it could be operated at a lower temperature, removed less metal, and was more stable – was preferable to the stannous chloride solution. Plated parts that had been pretreated in any of the metal chloride solutions investigated were capable of withstanding exposure to a water-saturated atmosphere at 200°F for at least ninety hours without showing signs of deterioration. Plated parts pretreated in the stannous chloride solution showed no signs of deterioration after five years of outdoor exposure. Author (NSA)

**N69-37967#** Michigan State Univ., East Lansing.
**CHEMISTRY OF HALOGEN CHARGE TRANSFER COMPLEXES Final Report, 1 Sep. 1963 – 15 Jun. 1967**
Alexander I. Popov 16 Jan. 1969 10 p refs
(Contract DA-31-124-ARO(D)-159)
(AD-689497; AROD-4424.6-C) Avail: CFSTI CSCL 7/3

Highlights are discussed of a project concerned with the study of the nature of halogen charge-transfer complexes and the mechanism of complex formation. Specifically interest was maintained in complex formation between heterocyclic amines and halogen, the role of solvent in the complexation reaction and in the preparation, and stability of complex perhalide anions. Author (TAB)

**N69-37974#** Conservatoire National Des Arts et Metiers, Paris (France). Electrochemistry Lab.
**STUDY OF THE MECHANISM OF THE ELECTROCHEMICAL OXIDATION OF HYDROCARBONS BY EXPERIMENTAL**

**SEPARATION OF REACTION STEPS Final Technical Report, Jan. – Dec. 1968**
M. Bonnemay, G. Brondel, D. Doniat, and E. Levart Jan. 1969 39 p refs
(Contract DAJA37-68-C-0506)
(AD-689477) Avail: CFSTI CSCL 7/4

A selective analysis of adsorption applied to a hydrocarbon - platinum system was used to obtain quantitative data concerning the initial activation energy of adsorption, the value of the adsorption interaction coefficient, and the number of sites occupied as the result of the adsorption of a molecule. These data were determined at temperatures of 80 and 90C in normal sulphuric acid. It was also possible to establish a comparison with diluted phosphoric acid in the case of certain reactants. The values obtained for the initial activation energy of adsorption and the number of sites show that, under these conditions, it is the end groups of the chain which are attacked, each group losing one hydrogen atom. In the case of a hydrocarbon having a branching chain, such as iso-butane, it is the three methyl groups which lose one hydrogen atom each. The initial activation energy of adsorption is higher as the chain is longer for the same number of groups affected in a molecule. On the other hand, the longer the chain the lower is the coefficient of interaction. Lastly, the higher the temperature the more pronounced is the dehydrogenation. Author (TAB)

**N69-38000#** Commissariat à l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucléaires.
**CONTRIBUTION TO THE STUDY OF URANOVANADATES: PRECIPITATION, STABILITY, AND FILIATION [CONTRIBUTION A L'ETUDE DES URANIVANADATES: PRECIPITATION, STABILITE ET FILIATION]**
Jacques Nicole (Ph.D. Thesis–Lille Univ., 7 Jun. 1967) May 1969 78 p refs In FRENCH; ENGLISH summary
(CEA-R-3704) Avail: CFSTI

The interaction of uranyl ions with vanadic anhydride leads to the formation of different uranovanadates according to which uranyl salt is used. With uranyl perchlorate solutions, uranotrimetavanadic acid H $[UO_2(VO_3)_3$ precipitates, and the excess uranyl ions then leads to the same compounds, although in this case there is prior formation of $UO_2UO_2(OH)_2VO_{32}$. Uranyl acetate on the other hand gives successively and quantitatively the acids H $[UO_2(VO_3)_3$, H $[UO_2(OH)VO_3$, and H $[UO_2(OH)_2VO_3$ and then the uranyl salt of this latter compound; the order in which the reagents are added is of no importance. The composition of the uranivanadates obtained by interaction of solutions of uranyl perchlorate and of the various vanadates depends on the ratio $Na_2O/V_2O_5$ of the vanadates considered. For ratios of less than unity, derivatives of uranotrimetavanadic acid are almost exclusively formed. For ratios equal to 3, the compounds are derivatives of uranometavanedic acid. In between these two ratios, the compounds are derivatives of both acids simultaneously. The changes in these compounds with changing pH confirm these results. Author (ESRO)

**N69-38003#** Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
**BEHAVIOR OF TRIVALENT ACTINIDES AND LANTHANIDE ELEMENTS IN CHLORIDE SOLUTION [COMPORTEMENT DES LANTHANIDES ET TRANSURANIENS TRIVALENTS EN MILIEU CHLORHYDRIQUE]**
Bernard Marin Jun. 1969 136 p refs In FRENCH; ENGLISH summary
(CEA-R-3803) Avail: CFSTI

The aim of this work is to compare the complexation in chloride solutions of trivalent lanthanides and actinides. The solvation of these cations without complexation was first studied and a difference between Am, Cm and rare earths was found (lanthanides can be separated into light and heavy rare earths). After establishing a simple theory of mobilities in complex solutions, electrophoresis on paper was used to study complexation. After investigating the hydrolysis of the cations in chloride solutions the complexation with the Cl ligand in solutions of HCl, $NH_4Cl$, $CaCl_2$, $CeCl_3$, LiCl was studied. It was found that the complexation is the same in dilute HCl solutions but in concentrated solutions the trivalent actinides are more complexed. This difference is sharper in LiCl solutions. Different models of the complexation in these solutions are proposed. Author (ESRO)

**N69-38004#** Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
**CONTRIBUTION TO THE STUDY OF THE $^{31}P-^{1}H$ SPIN-SPIN COUPLING CONSTANT N.M.R. IN TRI-COORDINATED PHOSPHORUS COMPOUNDS: INFLUENCE OF BOND ORIENTATION AND NATURE OF THE SUBSTITUANT AROUND THE PHOSPHORUS ATOM [CONTRIBUTION A L'ETUDE DES CONSTANTES DE COUPLAGE $^{31}P$, $^{1}H$ EN R.M.N. DANS LES COMPOSES ORGANO-PHOSPHORES TRICOORDINES. INFLUENCE DES FACTEURS GEOMETRIQUES ET DE LA NATURE DES SUBSTITUANTS AU NIVEAU DU PHOSPHORE]**
Jean-Bernard Robert (Ph.D. Thesis–Grenoble Univ., 25 Sep. 1968) Jun. 1969 121 p refs In FRENCH; ENGLISH summary
(CEA-R-3671) Avail: CFSTI

In order to investigate the influences of the configuration of the phosphorus atom and the substituants attached to it on the $J_{PH}$ spin-spin coupling constant an n.m.r. spectrum analysis of some tri-coordinated organo-phosphorus compunds was carried out. Coupling constants studied were $^{3}J_{PH}$ for the P-O-C-H and P-C-C-H fragments and $^{2}J_{PH}$ for the P-C-H fragment. The results showed that on the n.m.r. time scale there was no inversion of the bonds around phosphorus in the 1,3,2-dioxaphospholanes, 1,3,2-dioxaphosphorinanes, 3-phosphacyclopentène and 4-phosphorinanone. This conclusion held also for secondary phosphines. For a given geometry of the bonds joining the P and H atoms, and a given disposition of the bonds around the phosphorus atom, there was little influence of the nature of the substituants on the $J_{PH}$ spin-coupling constants. The geometrical dependence of $^{3}J_{PH}$ cannot be explained by a 'Karplus law'. The direction of the free doublet gives rise to a further effect on J. In the case of $^{2}J_{P\text{-}C\text{-}H}$, one can plot a curve $^{2}J_{P\text{-}C\text{-}H} = f(\alpha)$ $(0 \leq \alpha \leq 180)$, $\alpha$ denoting the dihedral angle of the two planes defined by the P, C and H atoms, and the second one by the P-C bond with the three-fold axis of the bond around phosphorus assuming a regular pyramidal arrangement. The function $^{2}J_{P\text{-}C\text{-}H} = f(\alpha)$ has two maxima, one for $\alpha = 0°$ ($^{2}J_{P\text{-}C\text{-}H} = 26$ c/sec) and the other for $\alpha = 180°$ ($^{2}J_{P\text{-}C\text{-}H} \simeq 0$ c/sec), and also a minimum for $\alpha = 110°$ ($|J^{2}_{P\text{-}C\text{-}H}| \sim 6$ c/sec). Author (ESRO)

**N69-38006#** Centre National de la Recherche Scientifique, Bellevue (France). Laboratorie des Hautes Pressions.
**STUDY OF PROFILE AND INTENSITY OF THE INFRARED SPECTRA OF HYDROGEN CHLORIDE, HYDROGEN BROMIDE AND THEIR MIXTURES IN LIQUID, CUBIC AND ORTHORHOMBIC SOLID PHASES [ETUDE DANS L'INFRAROUGE DU PROFIL ET DE L'INTENSITE DES SPECTRES DE HCl, HBr, ET DE LEURS MELANGES, EN PHASES LIQUIDE, SOLIDE CUBIQUE ET SOLIDE ORTHRORHOMBIQUE.]**
Parviz Khatibi (Ph.D. Thesis–Paris Univ., 24 Jun. 1969) 1969 152 p refs In FRENCH
Avail: CFSTI

Experimental results concerning the intensity, profile and structure of the infrared bands of hydracid molecules at low temperature and high pressure are presented. The study of the fundamental vibration-rotation absorption bands of pure HCl and HBr has been completed by a study of the first, second and third harmonics. A mixture of both acids was also studied. In the region of the first harmonic, which was specially studied, simultaneous transition bands were detected in the spectra of the pure solids and in the mixture HBr + HCl. Bands of the same nature were also

observed in the second harmonic. Quantitative interpretations of the different observed spectra are given along with values for the anharmonicity constant. ESRO

N69-38015*# National Aeronautics and Space Administration, Washington, D.C.
**WETTABILITY OF ELECTRON BOMBARDED TEFLON**
Teruo Tsunoda et al Sep. 1969 13 p refs Transl. into English from J. Chem. Soc. Japan (Tokyo), v. 71, no. 10, 1968 p 1691–1697 Presented at the 21st Meeting of the Chem. Soc. of Japan, 1 Apr. 1968
(NASA-TT-F-12532) Avail: CFSTI CSCL 07C

The contact angle of irradiated polytetrafluoroethylene was measured with respect to several liquids. It was found that the contact angle varied greatly depending on the conditions of irradiation. When irradiated at a specific reduced pressure, the contact angle decreased and wettability to several liquids was increased. An interesting result was the decreased wettability when the material was irradiated under high-vacuum conditions. It is thought that irradiation affects the chemical composition of the surface, crystallinity of the surface layer, crosslinking, and the geometric structure. The critical surface tension of the irradiated Teflon and the contribution of the London dispersion force to the surface energy were determined. Author

N69-38023# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
**INFLUENCE OF CRYSTAL DEFECTS ON THE CHEMICAL REACTIVITY OF RECOIL ATOMS IN OXYGEN CONTAINING CHROMIUM COMPOUNDS [INFLUENCE DES DEFAUTS CRISTALLINS SUR LA REACTIVITE CHIMIQUE DES ATOMES DE RECUL DANS DES COMPOSES OXYGENES DU CHROME]**
Tudor Costea (Ph.D. Thesis–Paris Univ., 12 Jul. 1968) Jun. 1968 98 p refs In FRENCH; ENGLISH summary
(CEA-R-3657) Avail: CFSTI

The influence of crystal defects on the chemical reactivity of recoil atoms produced by the reaction $^{50}Cr$ (n, $\gamma$)$^{51}Cr$ in oxygen containing chromium compounds has been studied. Three methods have been used to introduce the defects: doping ($K_2CrO_4$ doped with and non-stoichiometry (the semiconducting oxides of the $CrO_3$-$Cr_2O_3$ series). The thermal annealing kinetics of the irradiated samples have been determined, and the activation energy has been calculated. In all cases it has been observed that there is a decrease in the activation energy for thermal annealing in the presence of the defects. In order to explain the annealing process, an electronic mechanism has been proposed based on the interaction between the recoil species and the charge carriers (holes or electrons). Author (ESRO)

N69-38028# Naval Research Lab., Washington, D.C. Chemistry Div.
**A STUDY OF HYDROGEN EVOLUTION DURING AQUEOUS OXIDATION OF MILD STEEL**
S. H. Smith and M. C. Bloom 6 Jun. 1969 18 p refs
(AD-689738; NRL-6867) Avail: CFSTI CSCL 11/6

Steel is useful as a construction material for boilers only because the product of the easy reaction between steel and water is an insoluble oxide, which forms as a thin adherent film. As boiler operating temperatures are increased, however, the endurance and integrity of this protective film are pushed past their limits. The chemical reaction by which the film is generated is 3Fe2 + 4H2O yields Fe4O + 4H2, but in reality it is an electrochemical process. The substrate iron serves as the anode and the growing oxide film serves as a cathode; the circuit is completed by water, which serves as the electrolyte, and by direct contact between the iron and its oxide. It was envisioned that if the specific places in this system where hydrogen was evolved could be determined, more would be known about the mechanism. An apparatus was devised to measure against time the flow of hydrogen toward the metal side of the system and toward the solution side of the system under various controlled conditions. Permeation of hydrogen from one side of the system to the other under a known pressure differential was also measured. It was found that in the presence of strongly alkaline solutions (15%), hydrogen was evolved more toward the electrolyte, whereas with weakly alkaline (ph 11) solutions, the hydrogen went almost entirely toward the metal. It was also shown that hydrogen very readily permeates the oxide film grown from strong caustic solution as compared with a film grown from a pH 11 solution. These facts substantiate the premise of a porous film and indicate that oxidation is taking place both within the pores themselves and at places where the solution in these pores is contacting metal. Author (TAB)

N69-38038# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
**PREPARATION AND STUDY OF DIALKYL NITROXIDE RADICALS [PREPARATION ET ETUDE DES RADICAUX NITROXYDES DIACYLES]**
Pierrette Chenavas (Ph.D. Thesis–Grenoble Univ., 17 Jul. 1968) Jul. 1969 127 p refs In FRENCH; ENGLISH summary
(CEA-R-3687) Avail: CFSTI

The radicals are obtained by oxidation of N-hydroxymides with lead tetracetate or p-nitroperbenzoic acid, the imides having been prepared by heating dicarboxylic acid anhydrides with benzyloxyamine followed by catalytic hydrogenation of the N-benzyloximides so obtained. Two series of radicals were studied, i.e. five-membered cyclic imides, and six-membered cyclic imides, with and without methyl substituants on the carbon ring. The n.m.r. spectra of some O-benzyl imides have also been analyzed. These experiments have led to a study of the conformation and stereochemistry of these imides. Author (ESRO)

N69-38050# North American Carbon, Inc., Columbus, Ohio.
**ADSORBENTS: REVIEW AND PROJECTION**
J. Louis Kovach *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 148–166 refs (See N69-38042 22-22)
Avail: CFSTI

The method of iodine removal by adsorbents depends on both the chemical and physical properties of the iodine compound and the chemical and physical properties of the adsorbent employed. The gas–solid interaction is reviewed and attention is drawn to parameters influencing the iodine removal efficiency of adsorbents. Author

N69-38054# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
**EFFECT OF GAMMA RADIATION ON ADSORPTION OF IODINE AND METHYL IODIDE ON ACTIVATED CARBON**
L. R. Jones *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 204–226 refs (See N69-38042 22-22)
Avail: CFSTI

The effect of gamma radiation on the adsorption of iodine and methyl iodide on activated carbon exposed to flowing mixtures of steam and air is being measured. The steam-air-iodine mixtures are exposed to a radiation field of $\approx 2 \times 10^7$ rads/hr while flowing through a bed of test carbon. Preliminary tests, in which only relative humidity and velocity have been varied, show that the radiation field decomposed up to 90% of the methyl iodide. Test conditions simulated a postulated loss-of-coolant accident where adsorption of radio-iodine on carbon beds in the confinement system would produce an intense gamma radiation field. Author

N69-38060# Harvard Air Cleaning Lab., Cambridge, Mass.
**IN-PLACE IODINE REMOVAL EFFICIENCY TEST**
F. J. Vitez, Jr., R. A. Weker, and A. S. Goldin *In its* Proc. of the

10th AEC Air Cleaning Conf. Dec. 1968 p 335-338 (See N69-38042 22-22)
(Contract AT(30-1)-841)
Avail: CFSTI

The test objective is to measure the iodine concentration upstream and downstream of a charcoal filter, and thus determine its iodine removal efficiency. Samples are obtained by drawing air through two beds of copper beads in series. Tests of the overall method were performed using theoretical iodine concentrations of 0.0 to 0.2 ppm. In nearly all cases it was observed that: (1) No detectable iodine was found on the second bed of beads indicating that all available iodine was removed by the first bed. (2) The experimental concentration of airborne iodine on each test was smaller than that calculated theoretically, demonstrating difficulty in synthesizing known iodine concentrations in air. Author

N69-38062# Idaho Nuclear Corp., Idaho Falls.
**EVIDENCE FOR THE EXISTENCE OF HYPOIODOUS ACID AS A VOLATILE IODINE SPECIES PRODUCED IN WATER-AIR MIXTURES**
F. O. Cartan, H. R. Beard, F. A. Duce, and J. H. Keller *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 342-353 refs (See N69-38042 22-22)
Avail: CFSTI

A large amount of a nonelemental iodine species was observed in an experiment in which carrier-free I-131 was introduced into a steam-air filled containment vessel. Gas chromatographic analyses and the distribution of iodine on sampler components show that the species was not methyl or ethyl iodide. A volatile nonelemental species of iodine, like that observed in the large scale test, was generated in the laboratory by hydrolysis of iodine. Its volatility, limited stability, and the conditions of generation indicate that it is hypoiodous acid. Author

N69-38063# Idaho Nuclear Corp., Idaho Falls.
**INORGANIC ADSORBERS FOR SAMPLERS TO DIFFERENTIATE INORGANIC AND ORGANIC IODIDE SPECIES**
W. J. Maeck, J. H. Keller, H. R. Beard, and F. O. Cartan *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 354-361 (See N69-38042 22-22)
Avail: CFSTI

A wide variety of materials were investigated with emphasis on inorganic compounds that undergo chemical reactions with the iodine species. Based on these preliminary investigations, a two-component sampler appears promising in which elemental iodine is adsorbed on the first component and organic iodine is adsorbed on the second. Two promising materials for the first component are hydrous zirconium oxide (in the iodide form) which adsorbs elemental iodine by a heterogeneous exchange reaction, and finely divided bismuth metal dispersed on a support of activated alumina which adsorbs elemental iodine by a precipitation reaction. The retention of methyl iodide on both materials is less than 1%. Effective adsorbers of methyl iodide for the second component are activated alumina coated with silver nitrate or preferably a synthetic zeolite mineral which has been converted to the silver form. Both materials retain methyl iodide to greater than 99.9%. Author

N69-38068# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
**CONTRIBUTION TO THE STUDY OF MOLECULAR MOVEMENTS IN CYCLOHEXANE BY ELECTRON SPIN RESONANCE AND ELECTRON-NUCLEAR DOUBLE RESONANCE USING A RADICAL PROBE [CONTRIBUTION A L'ETUDE DES MOUVEMENTS MOLECULAIRES DANS LE CYCLOHEXANE PAR RESONANCE PARAMAGNETIQUE ELECTRONIQUE ET DOUBLE RESONANCE ELECTRONIQUE-NUCLEAIRE A L'AIDE D'UNE SONDE RADICALAIRE]**
Ferdinand Volino (Ph.D. Thesis--Grenoble Univ., 10 Jul. 1968) May 1969 94 p refs In FRENCH; ENGLISH summary
(CEA-R-3705) Avail: CFSTI

Solutions of stable free radicals of the nitroxide type have been studied as a function of temperature. In the plastic or globular state, the cyclohexane molecules have rapid rotational and diffusional movements and they transmit this movement to dissolved free radicals. Conversely, measurements by electron spin resonance of the absolute movement of the radicals, and by electron nuclear double resonance of their movement relative to the cyclohexane molecules give very precise methods for local analyses of the movements occurring in the cyclohexane matrix. These principles and techniques constitute the radical probe method. Author (ESRO)

N69-38090# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
**FIXATION OF METALLIC SULFOSALICYLATE COMPLEXES ON AN ANIONIC EXCHANGE RESIN [FIXATION DE COMPLEXES METALLIQUES SULFOSALICYLATE DANS UNE RESINE ECHANGEUSE D'ANIONS]**
Suzanne Cahuzac (Ph.D. Thesis--Paris Univ., 25 Jun. 1969) Jul. 1969 185 p refs In FRENCH; ENGLISH summary
(CEA-R-3826) Avail: CFSTI

Since sulfosalicylate ions have acid-base properties, sulfosalicylate complexes have an apparent stability which varies with the pH. As a result, the fixation of sulfosalicylates on an anionic exchange resin depends on the pH of the solution in equilibrium with the resin. This research has been aimed at studying the influence of the pH on the fixation, on an anionic exchange resin (Dowex 1 × 4) of sulfosalicylate anions on the one hand, and of metallic sulfosalicylate complexes on the other hand. In the first part of this work, the distribution of the sulfosalicylate ions in the resin was determined by frontal analysis, according to the pH and the total sulfosalicylate concentration in the aqueous solution in equilibrium with the resin. The exchange constants of these ions between the resin and the solution have been calculated. A study has also been made of the fixation of anionic sulfosalicylate complexes of Fe(III), Al(III), Cr(III), Cu(III), Ni(II), Co(II), Zn(II), Mn(II), Cd(II), Fe(II) and $UO_2^{2+}$. By measuring the partition coefficients of these different elements between the resin and the solution it has been possible to interpret the modes of fixation of the metallic ions, and to calculate their exchange constants between the resin and the solution. The relationships between partition coefficients, pH and total concentration of the complexant in solution have been established for each metallic element studied. Thus it is possible to predict, for given conditions, the nature of the species in solution and in the resin, as well as the partition coefficient of a metallic element. Finally, use was made of previous results to carry out some separations ($Ni^{2+}$ - $Co^{2+}$; $Ni^{2+}$ - $Co^{2+}$ - $Cu^{2+}$), as well as the purification of a uranyl sulfosalicylate solution. Author (ESRO)

N69-38096# Stanford Research Inst., Menlo Park, Calif.
**SENSITIVITY FUNDAMENTALS Semiannual Technical Progress Report, 16 Sep. 1968-15 Mar. 1969**
Marion E. Hill, Robert W. Woolfolk, Hans R. Bredfeldt, Derek Tegg, and Robert Shaw 31 May 1969 78 p refs
(Contract Nonr-3760(00))
(AD-689865; SRI-69-1) Avail: CFSTI CSCL 7/4

Studied were the following fundamental sensitivity properties of difluoramino compounds: The low-velocity detonation (LVD) wave characteristics of the liquid phase; The relation of shock sensitivity and failure diameter to the flow and the chemical reaction rate behind the shock front; The mechanism and kinetics of thermal decomposition of the compounds in the gas phase. The compounds chosen for this study are as simple as possible structurally, but at the same time they have physical properties that permit their use in each phase of the study. The model compounds are the bis difluoramino and tris difluoramino isomers of the propane series--primarily 1,2-, 1,3-, 1,1-, and 2,2-bis(difluoramino)propane; 1,2-bis(difluoramino)-2-methyl propane; 2,3-bis(difluoramino)butane,

in meso and dl forms; 1,2,2-tris(difluoramino)propane; and 2,3,3-tris(difluoramino)-butane. These compounds are being used so that the results from each experimental technique can be interrelated without having to account for effects caused by different functional groups, amount of carbon content, and chain branching. Through the use of isomers, structural effects on the results from a particular technique can be determined--for example, the differences in the effect of vicinal and geminate difluoramino groups on the ease of initiation and on the environmental stability of compounds containing them. A similar approach has begun with isomeric nitro compounds.
Author (TAB)

**N69-38103#** Leiden Univ. (Netherlands).
**SPUTTERING OF fcc METALS**
Dirk Onderdelinden (Ph.D. Thesis) 1968 88 p refs
(NP-17941) Avail: AEC Depository Libraries

Sputtering of fcc metals by ion bombardment is discussed including the influence of lattice structure on the energy transfer of the incoming ions. Typical dependence of the sputtering ratio on parameters like energy, mass, and angle of incidence of the incoming ion is demonstrated. The energy dependence and angular dependence of the ratio are shown for various ions incident on single crystals of Al, Au, Cu, and Pb. Maximums in the curves giving the energy dependence for normally incident ions shift towards high energies for heavier ions. Widths of minima are shown to be energy dependent. Interaction potentials used to calculate energy transfer of incoming ions are discussed. A power potential used in differential scattering cross section was derived. An extensive treatment of channeling incident ions is given. A comparison of the energy behavior of the width of the minima found for the sputtering ratio as a function of the angle of incidence and the critical angle for channeling suggests that a channeled particle does not contribute to sputtering.
Author (NSA)

**N69-38116#** Purdue Univ., Lafayette, Ind.
**ION-MOLECULE REACTIONS IN HYDROGEN SULFIDE, METHANE THIOL AND 2-THIOPROPANE**
J. L. Franklin and W. E. W. Ruska May 1969 41 p refs
(Contract N00014-67-A-0226)
(AD-689518; SQUID-TR-RICE-6-PU) Avail: CFSTI CSCL 7/4

The ion-molecule reaction in H2S, CH3SH, and (CH3)2S were observed at pressures up to 400 millitorr, using a quadrupole mass spectrometer with a single electron-impact ion source. Rate constants were measured for the disappearance of most primary ions and the appearance of several secondary ions, and mechaniams are proposed for the reactions observed. In all three cases, the major ion produced was the M + 1 ion (where M represents the mass of the parent ion), which reacted further to give the 2M + 1 ion. Charge exchange between the neutral gas and primary ions to produce the parent ion was observed in CH3SH and (CH3)2S and is suspected in H2S. In the cases of CH3SH and (CH3)2S, an additional reaction sequence originating with the (M - 1) ion was observed, while in H2S an additional sequence originating with the S(+) ion was found.
Author (TAB)

**N69-38120*#** Techtran Corp., Glen Burnie, Md.
**THEORY OF THE THERMOELECTRIC AND THERMOMAGNETIC PROPERTIES OF BISMUTH AT LOW TEMPERATURES [TEORIYA TERMOELEKTRICHESKIKH I TERMOMAGNITNYKH SVORSTV VISMUTA PRI NIZKIKH TEMPERATURAKH]**
I. Ya. Korenblit Washington NASA Sep. 1969 18 p refs Transl. into ENGLISH from Fiz. Tekh. Poluprov. (Moscow), v. 2, no. 10, Oct. 1968 p 1425-1435
(NASA-TT-F-12466) Avail: CFSTI CSCL 07D

Investigation of classical thermoelectric and thermomagnetic phenomena in bismuth at low temperatures when the main contribution to the thermal emf is made by the phonon capture of the carriers. A general expression is obtained for the partial thermal emf of the carriers of each constant energy ellipsoid. Assuming that the mutual capture of carriers and phonons is insignificant, a study is made of the thermoelectric and thermomagnetic coefficients as functions of the magnetic field in the n-type and natural bismuth. An analysis of the phonon spectrum of bismuth shows that simple expressions, suitable for analytical estimates, may be obtained with good accuracy for the frequencies and polarization vectors. The theoretical results agree with the experimental data.
Author

**N69-38121*#** Techtran Corp., Glen Burnie, Md.
**CHANGE IN THE CHEMICAL STRUCTURE OF CYANAMIDE ACCOMPANYING A CHANGE OF PHASE**
Y. Otagiri Washington NASA Sep. 1969 6 p refs Transl. into ENGLISH from Nippon Kagaku Zasshi (Tokyo), v. 70, 1949 p 263-265
(Contract NASw-1695)
(NASA-TT-F-12519) Avail: CFSTI CSCL 07C

The chemical structure of cyanamide was studied at normal temperature in the Tarugi-Lenci reaction with a change of phase. The chemical structure of the cyanamide molecule is an A=B-C= tautomer, however, the structure consists mainly of the B-type molecules in a normal temperature diluted solution. It increases the C-type molecules when the solution is acid or strong alkaline, it loses the C-type molecules when the solution is acid or strong alkaline, it loses the C-type molecules under fusion, and assumes the A-type in gaseous conditions. The Tarugi-Lenci reaction motivating a positive substance is believed to be the cyanamide of the A-type symmetrical structure.
Author

**N69-38122*#** Techtran Corp., Glen Burnie, Md.
**FORMATION AND PROPERTIES OF POLYAMIDE IMIDE**
S. Nishizaki et al Washington NASA Sep. 1969 10 p refs Transl. into ENGLISH from J. of the Chem. Soc. of Japan (Tokyo), v. 71, no. 9, 1968 p 1565-1568
(Contract NASw-1695)
(NASA-TT-F-12471) Avail: CFSTI CSCL 07C

Acromatic poly(amide-pyromellitamic acid dimethyl ester) (I) was obtained by a surface polycondensation method from a mixture of 4,4'-diamino diphenyl ether and 2,5-dicarbomethoxy terephthalic acid chloride and isophthalic acid. The fact that it changed into polyamide imide (II) by thermal cyclization of I was ascertained by TGA, IR and gas chromatography. Also, by means of TGA and DSC it was found that the cyclization temperature of I is the same as that of poly(pyromellitamic acid dimethyl ester) and is not affected by amide composition of I. In II, it was shown that alkaline hydrolysis is not apt to be incurred to the extent there is much amide composition, crystallinity is also high, and film vapor transmission is low. Also, the pyrolysis initiation temperature (TGA) of II was low to the extent there was much amide composition, and this tendency was especially great with pyrolysis in air.
Author

**N69-38136#** Transtek Associates, Reading, Mass.
**THE SPECTROSCOPY OF THE HYDROGEN MOLECULE NEAR ITS IONIZATION LIMIT**
F. J. Comes and H. O. Wellern May 1969 21 p refs Transl. into ENGLISH from Z. Naturforsch. (Tubingen), v. 23A, 1968 p 881-887
(AD-689186; AFCRL-69-0235; AFCRL-Trans-48) Avail: CFSTI CSCL 7/4

The absorption and ionization cross sections of molecular hydrogen for the wavelength region from 850 to 792 A are given. This region contains the dissociation and ionization limit as well. The rotational structure of the bands could partially be resolved in this experiment. As the dissociation of the molecule results in an excited hydrogen atom, this process can be followed by measuring the atomic fluorescence. Part of the excited atoms is found to be in the metastable 2 doublet s-state. From fluorescence as well as absorption and ionization measurements it can be shown, that even above the ionization limit the absorption due to the d-state of the

molecule leads to dissociation. The experimental results seem to point out, that the spectroscopic value of the ionization limit has to be shifted to lower energies. Author (TAB)

**N69-38136#** Avco Government Products Group, Lowell, Mass. Avco Space Systems Div.

**CHEMICAL KINETICS OF CARBONYL FLUORIDES DECOMPOSITION IN SHOCK WAVES**

A. P. Modica 15 Nov. 1968 34 p refs

(Contract F04701-68-C-0036)

(AD-689220; AVSSD-0247-68-RR; SAMSO-TR-69-145) Avail: CFSTI CSCL 7/4

An infrared technique has been used to monitor the thermal decomposition of carbonyl fluoride (COF2) in argon and nitrogen diluent behind incident and reflected shock waves. Data was taken in the temperature range 2400 deg to 3600 deg K, at total pressures between 0.2 and 26 atm. Direct sampling of reflected shock mixtures with a time-of-flight mass spectrometer provided knowledge of the decomposition products. The pressure and temperature dependence of the COF2 dissociation rate constants are discussed in terms of the Rice-Ramsperger-Kassel (RRK) unimolecular theory. Rate constants for the fluorine extraction reactions and COF disproportionation reaction were obtained by curve-fitting the complete COF2 kinetic histories with computed profiles. A chemical nonequilibrium stream-tube program which includes wall boundary layer effects was used for data analysis. Author (TAB)

**N69-38137*#** National Aeronautics and Space Administration, Washington, D.C.

**THE DETERMINATION OF DIELECTRIC CONSTANT IN THE ELECTROMAGNETIC SPECTRUM OF UNDAMPED OSCILLATIONS [ZUR BESTIMMUNG DER DIELEKTRIZITAETKONSTANTEN IM ELEKTROMAGNETISCHEN SPEKTRUM UNGEDAEMPFTER SCHWINGUNGEN]**

K. Theodortschick Sep. 1969 6 p refs Transl. into ENGLISH from Physik. Z. (West Ger.), v. 23, 1922 p 344 - 346

(NASA-TT-F-12671) Avail: CFSTI CSCL 07D

The resonance method is used to measure the dielectric constant of amyl and isobutyl alcohol in the wavelength range 26 - 182 meters. A qualitative evaluation of absorption is produced. The constants are found to be independent of wavelength in this range. Author

**N69-38139#** Bureau of Mines, Rolla, Mo. Metallurgy Research Center.

**VAPOR PRESSURES OF METAL HALIDES: THE CADMIUM CHLORIDE/TIN CHLORIDE, CADMIUM CHLORIDE/ZINC CHLORIDE, LEAD CHLORIDE/TIN CHLORIDE AND LEAD CHLORIDE/ZINC CHLORIDE BINARY SYSTEMS**

Lawrence C. George, A. Visnapuu, Barbara C. Marek, and Robert M. Doerr Oct. 1969 18 p refs

(BM-RI-7307) Avail: Issuing Activity

The Bureau of Mines measured the vapor pressures of selected mixtures in the binary systems $CdCl_2-SnCl_2$, $CdCl_2-ZnCl_2$, $PbCl_2-SnCl_2$, and $PbCl_2-ZnCl_2$ by the static pressure method. These data were evaluated by the second-law (sigma-plot) method. Equations expressing the vapor pressures and the heats and free energies of vaporization as functions of temperature are given. Author

**N69-38142*#** National Aeronautics and Space Administration, Washington, D.C.

**OLIGOIMIDES AND RETICULAR-STRUCTURED POLYIMIDES BASED ON THEM. [OLIGOIMDY I POLIIMIDY SETCHATOGO STROGENIYA NA IKH OSNOVE]**

Ye. B. Trostyanskaya et al Sep. 1969 10 p Transl. into ENGLISH from Polikondensatsionnre Plast. Massy (USSR), no. 9, 1968 p 20 - 23

(NASA-TT-F-12473) Avail: CFSTI CSCL 07C

A three stage synthesis of polyimides including obtaining oligoamide acids, dehydrating them to oligoimides and congealing the oligoimides to polyimides was performed. Author

**N69-38165#** Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.

**OXIDATION STUDIES OF IRON USING THE MOESSBAUER EFFECT. PART 1: PRELIMINARY EXPERIMENTS**

D. A. Channing and M. J. Graham May 1969 19 p refs

(RD/B/N-1384) Avail: AEC Depository Libraries

The potential of the Mössbauer effect for quantitative investigation of oxidation processes on iron is demonstrated. Different oxide phases formed simultaneously on thin foils in 1 atm of oxygen at 500°, 610° and 700°C were identified and analyzed using the technique. At 500° and 610°C $Fe_3O_4$ and $\alpha$-$Fe_2O_3$ were observed; their relative amounts depended upon the thermal treatment. At the lower temperature the vacuum reduction by iron of $\alpha$-$Fe_2O_3$ to $Fe_3O_4$ was followed, and conversely the growth of $\alpha$-$Fe_2O_3$ from $Fe_3O_4$ in oxygen. After oxidation at 700°C FeO was additionally found. Author (NSA)

**N69-38179#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

**FORMATION OF DISPERSED STRUCTURES IN HYDROCARBON MEDIA**

G. V. Belugina, S. Kh. Zakieva, and V. V. Konstantinova Mar. 1969 14 p refs Transl. into ENGLISH from the Russian

(AD-689713; FTD-HT-23-1169-68) Avail: CFSTI CSCL 7/4

The viscosity and the effect of aging on the viscosity of aluminum naphthenate and oleate soap dispersions in benzene and in T-1 organic fuel were investigated. The effect of adding various composite powders to the hydrocarbon-soap dispersions on the viscosity and mechanical strength of the resulting suspensions was studied. It was found that dispersion of AL-soaps of napthenic and oleic acids in hydrocarbon media is accompanied by formation of fibrous structures in the dispersion. The addition of metallic aluminum powder to the soap gels yielded stable suspensions, the viscosity of which is directly proportional to the viscosity of the gel. Author (TAB)

**N69-38217#** United Kingdom Atomic Energy Authority, Wantage (England). Isotope Research Div.

**THE IRRADIATION OF CARBON DIOXIDE CONTAINING SMALL AMOUNTS OF METHANE: THE FORMATION OF HYDROGEN**

J. A. Hearne and R. W. Hummel Feb. 1969 33 p refs

(AERE-R-6040) Avail: CFSTI; HMSO 5s

Carbon dioxide at atmospheric pressure and containing 2000 VPM methane, methane-$d_4$, or their equimolar mixture, with or without the addition of 1% carbon monoxide or 200 VPM oxygen, was irradiated with $^{60}Co$ $\gamma$ radiation over the temperature range 20 to 400°C. G-values for $H_2$, HD, and $D_2$ are reported, and possible reactions are discussed. Hydrogen is formed predominantly via H-atom reactions; formation by elimination of molecular $H_2$ from $CH_4$ is negligible. Energy transfer from excited $CO_2$ species to CO is postulated, in competition with transfer to $CH_4$. The latter appears to be temperature dependent. Author (NSA)

**N69-38248#** Atlantic Research Corp., Alexandria, Va. Kinetics and Combustion Group.

**A STUDY OF THE EXPLOSION LIMITS OF SIMPLE DIFLUORAMINO COMPOUNDS Final Report**

Guenther von Elbe, J. B. Levy, and G. White Jun. 1969 58 p refs

(Contract Nonr-4085(00))

(AD-689386; TR-PL-9812-00-0) Avail: CFSTI CSCL 7/4

Vapors of bis-difluoramino propanes C3H6(NF2)2 (DP)

and bisdifluoroamino butanes C4H7(NF2)2 (DB) were exploded either by raising the temperature or by adding fluorine. For the thermally induced explosion the experiments yielded explosion limits as functions of pressure p, temperature T and vessel diameter d. For the fluorine-induced explosion the experiments yielded explosion limits in terms of critical fluorine concentrations (F2)crit. The data show prima facie that the reaction is of the branched-chain type and that at the explosion limits the relation Rate of Chain Branching = Rate of Chain Breaking is applicable. Using this relation in conjunction with chemical analysis of the reaction products and auxiliary data from photochemical experiments, a reaction mechanism has been formulated for the DP isomers. The high sensitivity of the DB isomers to initiation of explosion by fluorine is the probable cause of premature reaction on admitting DB vapor to a heated reaction vessel. For IBA(2-Methyl-N-N'N'-tetrafluoro-1,2-propanediamine), this premature reaction has prevented the determination of limits for the thermally induced explosion. For 2,3-DB and 1,2-DB a method has been found to obtain such data. They show that the reaction mechanism is analogous to the mechanism for the thermally induced explosion of 1,3-DP. Author (TAB)

**N69-38254#** Atlantic Richfield Hanford Co., Richland, Wash.
**PLUTONIUM ASSAY BY CONTROLLED POTENTIAL COULOMETRY**
[1969] 12 p refs Presented at the 24th Northwest Regional Meeting, Amer. Chem. Soc., Salt Lake City
(ARH-SA-31; CONF-690606-1) Avail: CFSTI

A commercial multipurpose electroanalysis system was evaluated for precision assay of plutonium by controlled potential coulometry. Instrument design necessitated the use of electronic digital integration of electrolysis current instead of the more common capacitance type integration. Precision of individual results was 100 ± 0.15% at the 95% confidence level. Author (NSA)

**N69-38281#** Air Force Cambridge Research Labs., Bedford, Mass.
**OPTICAL EXCITATION IN THE CHARGE TRANSFER OF POSITIVE NEON IONS WITH THE MOLECULES NITROGEN, OXYGEN, CARBON DIOXIDE AT ENERGIES BELOW 250 EVOLT**
H. Schlumbohm May 1969 20 p refs Transl. into ENGLISH from Z. Naturforsch. (Tubingen), v. 23A, 1968 p 1386–1391
(AD-689167; AFCRL-69-0237; AFCRL-Trans-48) Avail: CFSTI
CSCL 7/4

An experimental investigation of the light emission being excited by charge transfer collisions between ground level Ne(+) ions and molecules of N2, O2, and CO2 at collisional energies up to 250 eVolts has shown optical excitation of the molecular ions being formed. The spectral scannings show the main system of N2(+) and mainly the first negative system of O2(+). Thus N2(+) is formed in the excited B doublet Sigma(u)(+) levels and O2(+) in the b quadruplet Sigma(g)(-) and to a smaller amount in the A doublet Pi(u) levels. Both reactions approach energy resonance within 1 to 3 eVolts as far as it is possible following the Franck-Condon principle. The spectral scannings measured with CO2 as the target molecule indicate that at almost equal rates CO2(+) is formed in the A doublet Pi(u) levels and by dissociative charge transfer CO(+) in the upper A doublet Pi levels of the observed comet-tail bands. The energy balance of this dissociative reaction is endothermic within 2.1 eVolts. The cross sections for the excitation of definite vibrational bands of CO2(+), CO(+), and N2(+) show threshold energies of several eVolts. After a primary increase the cross sections remain constant over the total energy range up to 250 eVolts. Only for the excitation of N2(+) a broad maximum between 20 and 30 eVolts was found. Author (TAB)

**N69-38282#** Illinois Univ., Urbana. Materials Research Lab.
**STUDY OF PRECIPITATION IN NIOBIUM–NITROGEN ALLOYS**
Daniel Roger Hennessy (M.S. Thesis) Jun. 1969 33 p refs
(Contract AT(11-1)-1198)
(COO-1198-631) Avail: CFSTI

Results of the investigations indicate that linear growth rates of precipitate thickening at subgrain boundaries have activation energy of 5.6 kcal/mole, which is less than the accepted value reported for bulk diffusion of nitrogen in niobium signifying that the simple discontinuous precipitation theory does not apply. Results from electron microscopy suggested a coarsening process initiating at the subgrain boundary precipitates. In a proposed discontinuous coarsening model, the sub-boundary precipitates thicken by diffusion of dissolved nitrogen from the matrix, across a denuded region, to the larger subgrain boundary precipitates. Author (NSA)

**N69-38280#** Goodyear Atomic Corp., Piketon, Ohio.
**MICROANALYSIS OF ANTIMONY, IRON, AND MOLYBDENUM IN NICKEL OR URANIUM BY ATOMIC ABSORPTION SPECTROSCOPY**
C. R. Walker, O. A. Vita, and R. W. Sparks 20 Jan. 1969 12 p refs
(Contract AT(33-2)-1)
(GAT-T-1479) Avail: CFSTI

The application of atomic absorption to the microdetermination of antimony, iron, and molybdenum in nickel and uranium is described. These elements are separated and concentrated by a single solvent extraction from 8N hydrochloric acid into n-amyl acetate. The extract is then analyzed directly by atomic absorption techniques. For the 95% confidence interval, the limits of error per analysis at the 1 ppm level are ±4, ±10, and ±6% for antimony, iron, and molybdenum, respectively. In general, the procedure is more rapid and yields more accurate results than colorimetric procedures for these elements. Since the amyl acetate–hydrochloric acid solvent extraction system can separate antimony, iron, and molybdenum from gross quantities of nickel or uranium (i.e., up to 25 g), the method is capable of detecting the elements at an extremely low level of about 0.05 μg/g. Author (NSA)

**N69-38292#** Mound Lab., Miamisburg, Ohio.
**SOLVENT EFFECTS IN QUICK-CURING FOAM SYSTEMS**
L. E. Brown and J. D. Nutter 28 May 1969 7 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1841) Avail: CFSTI

The effects of dilute organic solvents on the interaction of vinylcyclohexene dioxide (VCD) and trimethoxyboroxine (TMB), two materials used in the development of a rapid-curing epoxy foam system, were investigated and compared with results from previous studies. The reactions were monitored calorimetrically. The results indicated that the TMB–solvent interaction predominates over the TMB–VCD interaction. Of the solvents tested the two materials were most reactive with each other in 1,2-dichloroethane. The results obtained compared favorably with those from previous studies. Author (NSA)

**N69-38296#** Oak Ridge National Lab., Tenn. Office of Language Services.
**OXIDATION OF TUNGSTEN AND RHENIUM AT LOW PRESSURE**
Albert Cassuto et al. [1968] 6 p refs Transl. into ENGLISH from C. R. Acad. Sci. (Paris), v. 266, Ser. C, 1968 p 863–866
Sponsored by AEC
(ORNL-tr-2153) Avail: CFSTI

The surface oxidation rates of tungsten and rhenium were measured in a range of temperature between 1400 and 2500°K for oxygen pressures varying between $5.10^{-6}$ and $3.10^{-4}$ torr. The curves pass through a maximum which depends on the pressure, due to the production of atomic oxygen at high temperature (greater than 2000°K). These indicate the validity of the same type of equations which implies an analogous method of oxidation. Author (NSA)

N69-38298# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**HIGH-TEMPERATURE SORPTION OF NITROGEN BY NB-1 PERCENT Zr IN ULTRAHIGH VACUUM**
H. Inouye. May 1969 19 p refs
(Contract W-7405-ENG-26)
(ORNL-4403) Avail: CFSTI

The sorption kinetics of nitrogen by a filament of Nb–1% Zr was studied in ultrahigh vacuum to determine the variables that control the contamination rates of refractory metals by the residual gases in vacuum systems. The results are summarized in terms of the sticking probability, $\alpha$, which is defined as the ratio of the sorption rate to the incident rate of the gas at the alloy surface. In the temperature range 800 to 1600°C and at nitrogen pressures between $10^{-9}$ and $10^{-7}$ torr, $\alpha$ was found to be less than 0.10. The value of $\alpha$, which was dependent on the temperature, pressure, and nitrogen content of the alloy, could be described by the expression, $\alpha = \alpha_0(1 - C_m/C_e)$, where $\alpha_0$ has a maximum value of approximately 0.11, $C_m$ is the mean nitrogen concentration, and $C_e$ is the equilibrium concentration. It was also shown that $\alpha$ was dependent on the diffusivity of nitrogen in the alloy. The diffusivity of nitrogen was determined to be $D = 1.4 \times 10^{-5}$ exp $(-42,000/RT)$. Author (NSA)

N69-38308*# Wisconsin Univ., Madison. Dept. of Mechanical Engineering.
**EXPERIMENTAL STUDIES OF THE VAPORIZATION OF DROPLETS IN HEATED AIR AT HIGH PRESSURES**
C. William Savery. 1 Aug. 1969 180 p refs
(Grant NGR-50-002-017)
(NASA-CR-72574) Avail: CFSTI CSCL 07C

Measured histories of vaporizing n-heptane and Freon-13 droplets suspended in a heated air stream are reported. The range of air conditions was $1.5 < P < 100$ atm and $100 < T_\infty \leq 300°$ F. Comparisons are made with film theory calculations corrected for the effects of total pressure on thermodynamic properties. Agreement was satisfactory for liquid steady-state temperatures and mass transfer rates except for Freon-13 where significant differences were found at air pressures above 1.25 $P_c$. Freon-13 droplet histories were found to be completely unsteady for pressures above 60 atm. The absence of steady-state conditions was found to correlate with the critical mixing point for the Freon-13 air system. Author

N69-38315# Idaho Nuclear Corp., Idaho Falls.
**ANALYSIS OF IRRADIATED ZIRCONIUM CLAD THORIUM TUBES**
J. E. Fluegel, M. A. Wade, and E. M. Fortsch. Apr. 1969 19 p refs
(Contract AT(10-1)-1230)
(IN-1275) Avail: CFSTI

Four irradiated and two unirradiated zirconium-clad thorium tubes were dissolved and analyzed for uranium and thorium. The zirconium cladding was removed by dissolution in hydrofluoric acid. An insoluble double salt of zirconium and thorium was converted to the hydroxide of zirconium and thorium with sodium hydroxide and then dissolved with fuming perchloric acid. The thorium core of the sample was dissolved in nitric acid catalyzed with hydrofluoric acid. Thorium in the HF–Zr fraction was determined by emission spectroscopy and found to be negligible. Thorium in the dissolved residue fraction was determined gravimetrically after precipitation as oxalate and ignition to the oxide. Thorium in the $HNO_3$–Th fraction was determined volumetrically. Uranium was determined by isotopic dilution mass spectrometry after separation from the thorium and zirconium. NSA

N69-38330# Fordham Univ., New York. Dept. of Chemistry.
**MOESSBAUER EFFECT INVESTIGATION ON TIN BONDING**
Edward O. Kazimir (Ph.D. Thesis) 23 May 1969 196 p refs
(NYO-906-98) Avail: CFSTI

The relationship between Moessbauer effect parameters and the bonding of tin in tin-containing molecules is shown. After an exposition of the UNIXTL and PDRHXT programs, magnetic field (50 kgauss) data are presented for $(CH_3)_2SnF_2$. This data established that the electric field gradient in $(CH_3)_2SnF_2$ arises from an imbalance in the 5p orbitals and not from a $d\pi$-$p\pi$ mechanism. This result, however, does not mean that there is no $d\pi$-$p\pi$ bonding. In the presence of a large magnetic field, very small (0.3 mm/sec) and previously undetected quadrupole splittings could be observed. Two further techniques (oriented sample and the Kenyagin-Gol'danskii effect) were employed to determine the sign of the electric field gradient in $(CH_3)_2SnF_2$. Both showed that it is negative as was found in the magnetic field study. The relationship between the molecular geometry of tin-containing molecules and the Mössbauer effect parameters was established. Author (NSA)

N69-38335# Batelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**HYBRID METHOD FOR RESOLUTION OF ULTRACENTRIFUGE DATA**
Charles R. Cole. 9 Jan. 1969 10 p refs Presented at the Northwest Simulation Council Meeting, Portland, Oreg., 24 Jan. 1969
(Contract AT(45-1)-1830)
(BNWL-SA-2281; CONF-690106-1) Avail: CFSTI

A computerized method for qualitative and quantitative analysis of ultracentrifuge data on macromolecular concentrations from plots of counts of radioactivity per fraction versus the gradient layer (fraction number) is presented. The experimental method is briefly described. The curve fitting techniques solves an 18 parameter optimization problem using semi-automatic methods. The 3,000 iterative solutions required to fit one curve are generated by a hybrid computer in 5 minutes. Automatic optimization techniques can be developed to reduce the amount of computer time required. The automated method would also be more directly available to cell biologists. Author (NSA)

N69-38352# International Chemical and Nuclear Corp., Pittsburgh, Pa. Nuclear Science Div.
**MOESSBAUER SPECTROMETRY FOR ANALYSIS OF IRON COMPOUNDS**
R. C. Koch, H. K. Chow, and R. L. Bogner. Oak Ridge, Tenn. Oak Ridge Natl. Lab. Oct. 1967 62 p refs
(Contract AT(30-1)-3673)
(NSEC-4010-1) Avail: CFSTI

Metallurgical applications of Mössabauer effect spectroscopy for process development and evaluation, process control, and materials analysis require that the method be directly applicable to a variety of alloys and products having varying dimensions without the need for specialized specimen preparation. The feasibility of satisfying this requirement depends on the adaptation of the principles of the method to a practical system operable in a scattering configuration, capable of accepting existing material surfaces at environmental conditions and yielding the compositional and structural information for which Mössabauer effect spectroscopy is competitively or uniquely suited. It is feasible to design and construct such a Mössbauer effect scattering spectrometer and it is shown that practical industrial requirements exist for the types of measurements which such a system could provide. An experimental program is required to confirm and refine the Mössbauer effect scattering procedures which would provide the desired measurements. Author (NSA)

N69-38382# Argonne National Lab., Ill.
**NUCLEAR MAGNETIC RESONANCE SPECTRA IN BINARY MIXTURES OF INORGANIC FLUORIDES**
Lesley L. Williams (Ph.D. Thesis) Aug. 1968 92 p refs
(Contract W-31-109-eng-38)
(ANL-7501) Avail: CFSTI

The effects of solvent, concentration, and temperature on

the chemical shifts, line widths, and spin-spin coupling constants are reported for eight binary liquid inorganic fluoride mixtures from their high-resolution $^{19}F$ and $^{1}H$ nuclear magnetic resonance (NMR) spectra. The mixture systems studied were: $IOF_5-WF_6$, $IOF_5-IF_7$, $IOF_5-IF_5$, $IOF_5-BrF_5$, $IF_5-IF_7$, $HF-IF_7$, $HF-IOF_5$, and $HF-BrF_5$. A solvent effect for the $IOF_5$ line width was found in liquid $IF_5$ and $BrF_5$ solutions. For $IOF_5$ dilute in $IF_5$ at $-15°C$, the line width was reduced tenfold, revealing the second-order $AB_4$ pattern and yielding a fluorine coupling constant of $J_{FF} = 284 \pm 5$ Hz. Author (NSA)

**N69-38368*#** National Bureau of Standards, Washington, D.C.
**ELECTRODELESS ELECTROLYSIS OF SOLID ELECTROLYTES Semiannual Progress Report, 1 Nov. 1967–31 May 1968**
Abner Brenner and John Sligh. 1 Jun. 1968. 10 p
(NASA Order R-09-022-052; NBS Proj. 3120463)
(NASA-CR-105986; NBS-9889) Avail: CFSTI CSCL 07D

The glow discharge type of electrolysis described uses the electrolyte to form the septum between two partially evacuated chambers, one of them containing the positive and the other the negative electrical lead. Between 1000 and 3000 volts a glow discharge occurs extending from each electrode through the rarified gas to the electrolyte. Experimental electrolyses on fused salts of silver chloride produced dendrites of silver; experiments with cuprous chloride–potassium chloride eutectic and some copper turnings in the melt yielded about 60% efficiency production of copper dendrites. G.G.

**N69-38372#** Atomics International, Canoga Park, Calif.
**ANALYSIS OF SODIUM WITH SPARK SOURCE MASS SPECTROMETER**
H. Farrar, IV and C. H. Knox. 21 Jun. 1968. 22 p refs
(Contract AT(04-3)-701)
(AI-AEC-Memo-12719) Avail: CFSTI

A spark source Mattauch-Herzog mass spectrometer was applied to the analysis of sodium metal. Modifications to the source housing allowing the sodium to be introduced to the electrodes under vacuum resulted in the elimination of unwanted oxides and polymers. Liquid nitrogen cooling of the sodium prevents melting during the analysis. The results indicate that thermal ionization does not contribute to the sodium ion beam and that the sodium metal and the impurities within it behave like other metals during RF spark analysis. Efforts to more effectively control the mass spectrometer operating conditions and to measure the sensitivity for the different elements were begun. Author (NSA)

**N69-38373#** California Univ., Berkeley. Lawrence Radiation Lab.
**THERMODYNAMIC STABILITY OF CERTAIN INTERMETALLIC COMPOUNDS MADE FROM TRANSITION ELEMENTS**
Paul Richard Wengert. Apr. 1969. 118 p refs
(Contract W-7405-ENG-48)
(UCRL-18727) Avail: CFSTI

The Zr compounds of Re, Ru, Os, Rh, Ir, Pd, Pt, Ag, and Au were studied. Limits and estimates of the Gibbs free energy of formation of these compounds are determined by observing high temperature reactions of C and ZrC with the above elements and with their Zr compounds. The activity coefficients of Zr ($\gamma_{Zr}$) in the limit of 0% Zr are calculated from the three phase equilibria. No ternary compounds were observed for the above systems. In the case of the C–Zr–Re system, a molar ratio of Zr to Re of 19.0 to 81.0 was found in the hcp Re phase in the presence of C and ZrC indicating that this phase extended into the ternary system; therefore, no thermodynamic information could be determined by this method for the Zr–Re binary system. Miscellaneous properties of the binary alloys are given. Reactions of carbides, borides and nitrides with transition elements reported by other authors are reviewed. The Engel and Brewer concepts of crystal structure and bonding are included. Author (NSA)

**N69-38379*#** GCA Technology Div., GCA Corp., Bedford, Mass.
**TECHNIQUES APPLICABLE TO MASS SPECTROMETRY OF GASEOUS TRACE CONTAMINANTS Interim Report**
Peter Warneck, F. G. Satkiewicz, and J. A. Myer. May 1969. 102 p refs
(Contract NAS12-641)
(NASA-CR-86243; GCA-TR-69-4-N) Avail: CFSTI CSCL 07D

Methods of detecting gaseous trace contaminants were investigated with primary emphasis on three tasks: (1) Development and evaluation were conducted on a cryogenic target holder for the GCA solids-analysis mass spectrometer to be used in gas solidification and analysis. Test results are given for carbon dioxide, ammonia, water vapor, and heptane, as well as a description of the experimental technique. (2) The feasibility of using charge transfer as the source of sample ionization in a gas-analytical mass spectrometer was studied. Design criteria and construction details of such a source and the results of tests into its suitability are included. (3) The use of resonance scattering was evaluated as a means of pressure gage calibration in the ultra high vacuum region. Optimum conditions for the scattering are derived theoretically; a suitable apparatus is described, including light sources and detectors; and methods of optimizing light source operating conditions for the required application are explored. A.C.R.

**N69-38382#** Oak Ridge National Lab., Tenn. Chemical Technology Div.
**PREPARATION OF POROUS THORIA BY INCORPORATION OF CARBON IN SOLS**
K. J. Notz. Dec. 1968. 59 p refs
(Contract W-7405-eng-26)
(ORNL-TM-1780) Avail: CFSTI

Porous thoria with a wide range of controlled porosity was prepared by a sol-gel technique. Carbon was incorporated in thoria sols to produce stable mixed sols, which were gelled as either shards or microspheres. Subsequent removal of the carbon by combustion in air under appropriate conditions yielded thoria with porosities ranging from less than 1 to 72%. The two major variables affecting porosity are the $C/ThO_2$ mole ratio and the firing schedule. Surface area and density data, in conjunction with porosity values, were used to construct a realistic interpretation of the gelation and the sintering mechanisms. The kinetics of carbon burnout was studied, and an activation energy of 41 kcal/mole was determined for burning in air at 440 to 500°C. Carbon removal with steam, $CO_2$, and hydrogen was examined briefly. Porous $(Th,U)O_2$ was also prepared by the same method used for porous $ThO_2$. Author (NSA)

**N69-38389#** Michigan Univ., Ann Arbor. Dept. of Chemistry.
**THERMAL AND ELECTRONIC BEHAVIOR OF THE RARE EARTH HEXABORIDES FROM CRYOGENIC CALORIMETRY**
Edgar F. Westrum, Jr. Apr. 1969. 18 p refs. Presented at the Intern. Symp. on Rare Earths, Paris and Grenoble, France, 6-10 May 1969
(Contract AT(11-1)-1149)
(COO-1149-149; CONF-690517-1) Avail: CFSTI

The fundamental problems associated with the interpretation of the electronic and physical properties of these isostructural CaCl-type structures have not advanced greatly in recent years. This no doubt is partly occasioned by the technical problems encountered in obtaining highly purified, well-characterized samples. Precise, cryogenic thermal measurements have now been completed on $LaB_6$, $CeB_6$, $PrB_6$, $NdB_6$, and $GdB_6$. The heat capacity of $LaB_6$ is of normal sigmoid behavior without thermal anomalies (without evidence of superconductivity in accord with resistivity measurements but contrary to other claims). The other hexaborides studied all showed cooperative, anti- to para-magnetic $\lambda$-type

transitions near 10°K followed by complex Schottky transitions with maxima between 20 and 80 K. Author (NSA)

**N69-38402#** Iowa State Univ. of Science and Technology, Ames. Ames Lab.
**REACTIONS OF THORIUM CARBIDE IN A FUSED SALT-LIQUID METAL SYSTEM**
Peter Michael Iverson (M.S. Thesis) Feb. 1969 62 p refs
(Contract W-7405-eng-82)
(IS-T-300) Avail: CFSTI

Three methods of recovering spent thorium carbide were investigated. The first involved the reaction between liquid zinc and thorium carbide. The expected reaction product was $ThZn_{8.5}$. Over the temperature span of 500 to 800°C and for equilibration times of up to three days, there was no appreciable amount of $ThZn_{8.5}$ formed. Thorium carbide was also equilibrated with excess $ZnCl_2$ in a LiCl–KCl salt system at 500°C. After 20.5 hrs the reaction was essentially complete. During the first 8 hours the reaction was observed to be kinetically of the zeroeth order. A reaction rate coefficient k of $8.7 \times 10^{-3}$ moles-liter$^{-1}$-hr$^{-1}$, with respect to $ThCl_4$, was measured. Electrolysis of $ThC_2$ in a fused LiCl–KCl electrolyte using a molten zinc cathode was investigated at 500°C. The metal product was a 10 to 16% Th–Zn sponge deposited on a tantalum stirrer above the surface of a 2 to 5% Th–Zn alloy. Author (NSA)

**N69-38407#** California Univ., Livermore. Lawrence Radiation Lab.
**COMMENTS ON SOME OF THE PHYSICAL CHEMICAL QUESTIONS ASSOCIATED WITH THE ANALYSIS OF WATER IN EARTH MATERIALS**
Edward Catalano Apr. 1969 14 p refs Sponsored by AEC
(UCRL-50630) Avail: CFSTI

A discussion of various physical chemical questions associated with the quantitative determination of water in earth materials is presented. A pseudothermodynamic approach to the binding of water in various types of earth materials is also presented. Emphasis is placed on the fact that as pore, crack, or hole sizes approach molecular dimensions, the interaction energy of water with the host material can become very large. A scale of interaction energies is suggested that would be useful for specifying operationally relevant analyses in earth materials. Author (NSA)

**N69-38418#** Junta De Energia Nuclear, Madrid (Spain). Direccion De Quimica E Isotopos.
**QUANTITATIVE SPECTROGRAPHIC DETERMINATION OF TRACES OF MANGANESE IN FERRIC OXIDE [DETERMINACION ESPECTROGRAFICA CUANTITATIVA DE TRAZAS DE MANGANESO EN OXIDO FERRICO]**
C. Capdevila and M. Roca 1968 11 p refs In SPANISH
(JEN-202-DQ/I-69) Avail: AEC Depository Libraries

In order to enhance the sensitivity, different electrode types and sweeping substances were studied. Graphite anodes, with 5 × 2.5, 4 × 4.5, 4 × 8 and 7 × 10 mm craters, as well as $CuF_2$, AgCl, ZnO, and graphite powder as sweeping materials, were tested. A JACO-Ebert grating spectrograph and 10-amp dc arc were employed employed and the proper exposure times chosen from moving-plate studies. Using 4 × 4.5 mm electrodes and 75% AgCl, a detection limit of 0.2 ppM is attainable. Author (NSA)

**N69-38424#** Los Alamos Scientific Lab., N.Mex.
**A STUDY OF V(III)-V(IV) AND Ti(III)-Ti(IV) ISOTOPIC EXCHANGE REACTIONS IN ACID SOLUTIONS. PART A: LIGAND CATALYSIS OF THE V(III)-V(IV) EXCHANGE REACTION. PART B: THE Ti(III)-Ti(IV) ISOTOPIC EXCHANGE REACTION IN PERCHLORIC AND HYDROCHLORIC ACID SOLUTIONS; THE Ti(III, IV) BINUCLEAR COMPLEX IN SULFURIC ACID**
Charles J. Orth (Ph.D. Thesis - N.Mex. Univ.) 30 Apr. 1969 215 p refs
(Contract W-7405-eng-36)
(LA-4147) Avail: CFSTI

The rate of exchange of radioactive $^{48}V$ between V(III) and V(IV) has been measured in aqueous acid solutions containing various ligands including perchlorate, fluoride, chloride, bromide, iodide, sulfate, phosphate, oxalate, ethylene glycol, glyoxal, acetate, glycolate, glyoxalate, malonate, maleate, fumarate, and succinate. The V(IV) was separated from the V(III) by elution from cation exchange resin columns with 2 M $HClO_4$. Rate laws are given for the V(III) – V(IV) exchange in the presence of hydrofluoric, sulfuric, or oxalic acid. In addition to the rate laws for these three systems, overall activation energies and entropies have been determined and reaction mechanisms are proposed. The rate of exchange of radioactive $^{44}Ti$ between Ti(III) and Ti(IV) in 1 M $HClO_4$, 1 M HCl, and 11 M HCl has been investigated, and in all cases, the exchange was found to be too rapid to be measured by the isotope labeling technique. NSA

**N69-38427#** Technische Hochschule Darmstadt (West Germany). Eduard-Zintl-Inst.
**SEPARATION OF IODINE IN GASEOUS PHASE BY MEANS OF SEPARATION COLUMNS**
J. Oberhansberg Apr. 1969 97 p refs In GERMAN
(BMwF-FBK-69-12) Avail: AEC Depository Libraries

An experimental device was developed to measure the separation of iodine from $CO_2$ and $N_2$ in the range of $10^{-1}$ to $10^{-7}$ g $I_2/m^3$. Decontamination factors (DF) on the order of $10^4$ to $10^5$ were measured using columns loaded with AgCl on silica gel ($AgCl/SiO_2$) or 5 Å Linde molecular sieves or activated charcoal. Higher DF were obtained by increasing the gas flow and the time of contact. In order to achieve high DF values (on the order of $10^4$ to $10^5$) the presence of water is important in case of $AgCl/SiO_2$, whereas the absence of water is important in the case of molecular sieves. Activated charcoal yields high DF values independent of water content. The advantage of $AgCl/SiO_2$ as column material is its high selectivity for iodine. Author (NSA)

**N69-38431#** Virginia Univ., Charlottesville. Dept. of Chemistry.
**A POLYHEDRAL GALLACARBORANE**
Russell N. Grimes and William J. Rademaker Jul. 1969 8 p refs
(Contract Nonr-474(13))
(AD-690220; TR-5) Avail: CFSTI 07/3

Dicarbahexaborane (8) with trimethylgallium at 215C produces a new compound characterized as 1-methyl-1-galla-2,3-dicarba-closo-heptaborane (7), in which a gallium atom is present in a polyhedral cage system. The identification and structural assignment is based on detailed mass spectroscopic analysis, boron-11 NMR, Proton NMR, and infrared spectra. Author (TAB)

**N69-38436#** Mound Lab., Miamisburg, Ohio.
**DETERMINATION OF As(III) BY CONTROLLED-POTENTIAL COULOMETRY**
D. R. Bohl, F. A. Koehler, and D. E. Sellers 20 May 1969 10 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1602) Avail: CFSTI

A controlled-potential coulometric procedure was extended for use in the determination of microgram quantities of arsenic. Improved sensitivity and accuracy were obtained by using a small titration cell in conjunction with an electronic solid-state, controlled-potential coulometer (Model 810, Monsanto Research Corporation). Results for twenty-seven As(III) determinations at the 120 to 380 μg level had an average error of +0.19% and a relative standard deviation of ±0.22%. The controlled-potential coulometric procedure for determination of As(III) compares favorably to constant-current coulometric procedures, but the titration end-point using the controlled-potential method is easily determined without the requirement of special apparatus. Author (NSA)

N69-38485# California Univ., Livermore. Lawrence Radiation Lab.
**ANALYTICAL CHEMISTRY ANNUAL REPORT**
J. E. Harrar (ed. and comp.) 16 Apr. 1969 83 p refs
(UCRL-50006-69) Avail: CFSTI

Activities for the year 1968 in the department of analytical chemistry are reported. Electron microprobe studies were conducted on aluminum alloys and their systems, germanium semiconducting single crystals, the presence of lead and zinc in silver and silver alloy tubes, and different types of steel. Apparatus was designed for the determination of deuterium and deuterium hydride; gas chromatographic equipment was designed for the analysis of helium and krypton in the atmosphere, and trace amounts of rare gases in soils. Methods for the analysis of trace amounts and impurities of boron and carbon were compared. Spectral studies using a variety of instruments were completed for einsteinium-253 and its ionic form, berkelium-249, and nitrogen. Other analytical investigations were completed for ethylene polymers, fluorides, fluorine, hafnium, manganese, molybdenum, pentaerythritol tetranitrate, rhenium, titanium, and tungsten. M.H.E.

N69-38510# Kernforschungszentrum, Karlsruhe (West Germany). Institute fuer Heisse Chemie.
**H-1 AND P-31 NMR INVESTIGATION OF THE EXTRACTION PROPERTIES OF ORGANOPHOSPHORUS COMPOUNDS. 2. THE SYSTEM TRIBUTYLPHOSPHATE-DODE CANE-URANYL NITRATE-NITRIC ACID-WATER**
R. Von Ammon, G. Baumgaertel, and P. Dressler Feb. 1969 26 p refs In GERMAN
R. Von Ammon, G. Baumgaertel, and P. Dressler
(KFK-920) Avail: AEC Depository Libraries

The influence of the uranium concentration on the chemical shift of the $\alpha-CH_2$ protons, the phosphorus atom, and the $HNO_3/H_2O$ protons in the system TBP–dodecane–uranyl nitrate–$HNO_3$–$H_2O$ was investigated. In almost all cases a negative total shift was observed. Complex formation in the system was studied by NMR techniques. NSA

N69-38511# Mound Lab., Miamisburg, Ohio.
**A METHOD FOR DETERMINING THE PARTICLE SIZE OF AIRBORNE DUST**
C. T. Meyer, H. F. Anderson, and J. B. Kahle 1 Jun. 1969 8 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1596) Avail: CFSTI

A technique was developed to determine particle size of airborne particulates using electron microscopy techniques. Particle sizes were determined by comparing photomicrographs of polystyrene spheres of known diameters with photomicrographs of the particulates. Author (NSA)

N69-38515# Iowa Univ., Iowa City. Dept. of Chemistry.
**RESEARCH IN HIGH-TEMPERATURE PHYSICAL CHEMISTRY, PARTICULARLY THE VAPORIZATION OF REFRACTORY SULFIDES Technical Progress Report, 1 Apr. 1968–1 Apr. 1969**
E. David Cater 15 Apr. 1969 20 p refs
(Contract AT(11-1)-1182)
(COO-1182-29) Avail: CFSTI

Work is being carried out to obtain molecular parameters and ground-state degeneracies of high-temperature molecules produced by the vaporization of refractory oxides and sulfides of the transition, rare earth, and actinide metals. Some fluorides are also being studied. The technique and equipment used are described. NSA

N69-38520# Notre Dame Univ., Ind. Radiation Lab.
**BIBLIOGRAPHY ON THE RADIATION CHEMISTRY OF ALKANES**
Eve-Marie Potvin and Alberta B. Ross May 1969 68 p refs Sponsored by AEC
(COO-38-661) Avail: CFSTI

Literature on the radiation chemistry of alkanes is covered by this bibliography. Investigations of aqueous solutions of alkanes are not included. The papers are listed by serial number that is approximately chronological under the following categories: gas phase, liquid phase, solid phase, heterogeneous systems, radiation synthesis, oxidation, and books and reviews. An author index and compound index are included. NSA

N69-38525# Illinois Univ., Urbana.
**MICROPHOBE ANALYSIS OF PHASES IN Nb-N ALLOYS**
Howard Savage Jun. 1969 41 p refs
(Contract AT(11-1)-1198)
(COO-1198-634) Avail: CFSTI

The compositions of nitride and solid solution phases in equilibrated Nb–N alloys and an equilibrium specimen of a Nb 0.86 wt % Zr-3.6 wt % N alloy were measured by microprobe analysis. Hardness readings were made on all the specimens. Specimens were prepared to minimize oxygen contamination and to provide representative materials for analysis. The phases studied in the equilibrated specimens were the metal-nitrogen solid solution and the dispersed and grain boundary precipitate, $Nb_2N$. It was found that matrix compositons can be determined using the microprobe analyzer, but not to as great a precision as by internal friction studies; nitride phases are satisfactorily analyzed provided they are massive enough and are equilibrated for sufficiently long times; the distribution of a minor element (Zr) in an alloy can be traced effectively even when present in fractions of a wt %. Author (NSA)

N69-38528# Ludwig-Maximilians-Universitat, Munich (West Germany). Inst. Fuer Anorganische Chemie.
**VAPOR PRESSURE OF PROTACTINIUM (V) CHLORIDE [DER DAMPFDRUCK DES PROTACTINIUM(V)-CHLORIDS]**
F. Weigel, G. Hoffmann, and N. Ter Meer 1969 12 p In GERMAN
(NP-17906) Avail: AEC Depository Libraries

The vapor pressure of anhydrous protactinium (V) chloride was measured by means of a pyrex sickle gage in the temperature range from 500° to 600°K. The temperature dependence of the vapor pressure of molten $PaCl_5$ may be described by the equation: ln p(mm Hg) = 17.27 – 7377/T for the temperature dependence of the vapor pressure of solid $PaCl_5$ and the equation ln p (mm Hg) = 23.87 – 11,162/T was obtained. Extrapolation of the first to 760 mm Hg yielded a value of 693°K (=420°C) for the boiling point of $PaCl_5$. From the vapor pressure data, the following thermodynamic parameters were calculated: entropy of vaporization $\Delta S_v$ = 21.1 eu, heat of vaporization $\Delta H_v$ = 14.65 kcal/mole, entropy of sublimation $\Delta S_s$ = 34.2 eu, and heat of sublimation $\Delta H_s$ = 22.17 kcal/mole. The Gibbs energy at the melting point was calculated to be $\Delta G_m$ = 2.4 kcal/mole. Author (NSA)

N69-38548# Aeronautical Research Labs., Melbourne (Australia).
**THE EFFECT OF COMPOSITION AND PURITY ON THE NEEL TEMPERATURE OF CrN**
T. Mills Mar. 1969 21 p refs
(ARL/MET-74) Avail: CFSTI

The antiferromagnetic-paramagnetic transition of CrN at about 0°C, during which the structure changes from orthorhombic to cubic, was selected for studying the effects of composition and purity. Since the transition involves a structure change, a dilatometric method was used as the simplest way of studying it. The nitrides were prepared by reacting nitrogen with chromium powder of size less than 100 mesh. The chromium powder contained 0.3 wt% oxygen, and although further contamination by oxygen was prevented by using a titanium getter, this 0.3 wt% oxygen persisted in the specimens throughout the tests. The effect of this oxygen impurity on the properties of the CrN was determined by studying composition, homogeneity, and purity. It was found that

CrN exists over a composition range with the Neel temperature varying from 275.6 to 284.7 K. Pure CrN has a dissociation temperature of 1048°C at 1 atmosphere pressure of nitrogen. Oxygen impurity in CrN lowers the Neel temperature and stabilizes the CrN. K.W.

**N69-38554#** Tennessee Univ., Knoxville. Dept. of Chemistry.
**EMF, VOLTAMMETRIC AND SPECTROPHOTOMETRIC MEASUREMENTS ON THE U(IV)/U(III) COUPLE IN MOLTEN LITHIUM FLUORIDE-BERYLLUIM FLUORIDE-ZIRCONIUM FLUORIDE**
H. W. Jenkins, G. Mamantov, D. L. Manning, and J. P. Young 24 Jan. 1969 2 p refs Presented at the 135th Natl. Meeting of the Electrochem. Soc., New York Prepared for ORNL
(Contract AT(40-1)-3518)
(ORO-3518-11; Conf-690506-2) Avail: CFSTI

Potentiometric determination of the U(IV)/U(III) ratio requires the value of the standard electrode potential of the U(IV)/U(III) couple relative to the standard electrode potential of a reference couple. The standard potential of the U(IV)/U(III) couple was calculated with respect to a hypothetical unit mole fraction Ni/Ni(II) electrode from emf measurements on the galvanic cell Pt/U(IV), U(III)//Ni(II)/Ni. The cell potential was measured as a function of the U(IV)/U(III) ratio which was varied by controlled reduction of U(IV) to U(III) with a Zr rod immersed in the solution. The U(IV) and U(III) concentrations were determined spectrophotometrically. A simple voltametric method was also developed for the determination of the U(IV)/U(III) ratio, when U(IV) >> U(III). The method involves the measurement of the potential difference between the equilibrium potential of the melt, measured by an inert Pt electrode immersed in the melt, and the voltammetric equivalent of the standard potential of the U(IV)/U(III) couple, $E_{1/2}$. NSA

**N69-38559#** Union Carbide Corp., Oak Ridge, Tenn.
**PRESSING POWDER SAMPLES FOR SPARK-SOURCE MASS SPECTROGRAPHIC ANALYSIS**
J. C. Franklin, W. W. Rice, and C. W. Catlett 19 Jun. 1969 20 p refs
(Contract W-7405-ENG-26)
(Y-1676) Avail: CFSTI

Two methods were developed for pressing powder samples for mass spectrographic analysis. Both methods involve isostatic pressing of the sample, with or without an electrically conducting support medium, in a naphthalene mold. The methods were applied to a wide variety of matrix materials, both conducting and insulating, and were found to be structurally effective about 98% of the time. The pressure vessel in which the samples are pressed uses a mineral oil pressing fluid and provides pressures in the range of 30,000 to 180,000 psi. Author (NSA)

**N69-38562#** Atomics International, Canoga Park, Calif.
**SOLUBILITY OF BISMUTH IN LIQUID SODIUM**
D. C. Gehri and R. J. Sullivan 1 Jun. 1969 22 p refs
(Contract AT(04-3)-701)
(AI-AEC-12770) Avail: CFSTI

The solubility of bismuth in liquid sodium was studied at 200 to 650°C, using a specially prepared $Na_3Bi$ solute and a very high-purity sodium. A capsule technique, involving a physical separation of the excess solute from the solution, was used for the experiments. Chemical analyses were performed, using atomic absorption spectrophotometry. The results were combined with those of two other laboratories, to yield two separate solubility expressions from which heats of solution have been individually calculated. The expressions recommended for describing the solubility of bismuth in liquid sodium in specific temperature ranges are given. One of these expressions was derived from data which may reflect the influence of Na–Bi–O interactions, and it should be used only with this qualification understood. No such restriction is placed on the other expression, which is therefore recommended without qualification for describing the solubility of elemental bismuth in sodium. Author (NSA)

**N69-38568#** Union Carbide Nuclear Co., Oak Ridge, Tenn. Gaseous Diffusion Plant.
**METHOD OF ISOTOPIC SEPARATION. PART 1: PHOTOCHEMICAL SEPARATION OF ISOTOPES**
J. P. Morand et al [1969] 25 p refs Transl. into ENGLISH from Energie Nucl. (Paris), v. 10, no. 6, 1968 p 362–366
(K-Trans-51) Avail: CFSTI

A photochemical process for the separation of isotopes is possible in certain cases. After a study of the conditions required for such a separation, the particular case of selective oxidation of mercury isotopes by oxygen in the presence of butadiene and by ultraviolet irradiation at a wavelength of 2537 Å was considered. The set of reactions leading to the formation of enriched mercuric oxide is presented. The practical conditions for separation of the isotopes 202 and 196 of mercury were studied. Author (NSA)

**N69-38582#** Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
**CHEMISTRY PROGRESS REPORT**
31 Dec. 1968 102 p refs
(Contract AT(30-1)-905)
(MIT-905-133) Avail: CFSTI

Physical and nuclear chemistry progress for 1968 is reported. Organic isotopes are studied for recombination, decomposition, and molecular behavior. Nuclear instrumentation for chemical abstraction processes are presented. Included is a chemiluminescence and photoluminescence study of ruthenium chellates. Work on decay and fission studies, activation analysis, vapor determination, and liquid equilibrium measurements are also examined. E.H.W.

**N69-38586#** Sundstrand Aviation-Rockford, Ill.
**ORGANIC RANKINE CYCLE TECHNOLOGY PROGRAM Quarterly Progress Report, 1 Jan.–1 Apr. 1969**
R. E. Niggemann 15 Apr. 1969 34 p refs
(Contract AT(04-3)-851)
(SAN-651-96; QPR-12) Avail: CFSTI

Loop No. 1, with the eutectic mixture of biphenyl and biphenylether as the working fluid at a boiler outlet temperature of 700°F, was the only loop to be operated. The loop suffered a severe overtemperature resulting in extreme fluid degradation and the rupture of a weld. The test was subsequently terminated with an accumulated total of 6367 hours operation. The eutectic continued to show excellent stability up to the time that final shutdown occurred. Total degradation, linearly extrapolated to 10,000 hours, is only 0.126 per cent. This is higher than previously reported because new improved analytical methods have resulted in the discovery of additional high boiling point degradation products. Successful testing of the plain journals was performed and calibration data are complete. One successful run was made with the floating pad bearings, but a full speed rub occurred after four minutes operation. No significant damage resulted. The pump test rig was tested. Investigation of the head flow characteristics for the high flow rate jet condenser pump was completed. NSA

**N69-38589#** Fordham Univ., New York. Dept. of Chemistry.
**PREPARATION AND STRUCTURAL STUDIES OF SOME TRANSITION METAL CHELATES OF FUROYL TRIFLUOROACETONE**
William O. Mc Sharry (Ph.D. Thesis) 1969 91 p refs
(NYO-906-85) Avail: CFSTI

Chelates of the general formula $NH_4M^n(FTA)_{n+1}$ where M is a metal of valence n and FTA is 4,4,4-trifluoro-1-(2-furyl)-1,3-butanedione, were prepared with Mn(II), Fe(II), Co(II), Ni(II), Cu(II), Zn(II), and Cd(II). An attempt to prepare a similar compound with Cu(II) produced only the normal chelate. The crystal and molecular structure of $NH_4Cd(FTA)_3$ was determined from approximately 700 three-dimensional x-ray film data. The structure was refined by least squares to a conventional crystallographic weighted R factor of 7.0%. Powder patterns of the

other tris chelates indicate similar structures to the cadmium chelate. Infrared spectra of the compounds are similar to those of normal acetylacetonates and show a relationship between stability constant and frequency for certain bands. The ultraviolet spectra of all the tris chelates are almost identical. Visible spectra are quite anomalous with respect to both intensity and frequency of absorption. Author (NSA)

# 07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

**N69-37261#** RAND Corp., Santa Monica, Calif.
**ON THE CONVERGENCE OF ERROR PROBABILITIES FOR SIGNAL DETECTION**
Percy A. Pierre Jan. 1969 8 p refs
(AD-689153; P-4112) Avail: CFSTI CSCL 9/4

In Kelley, Reed, and Root (1960), it was shown that if the log of the likelihood ratio for detecting a signal in stationary Gaussian noise is phi sub T when the data is z(t), t epsilon (-T,T) and phi when the data is z(t), t epsilon (minus infinity, infinity), then Var phi sub T increases monotonically to Var(phi) as T approaches infinity. Recently, this result was extended to vector-valued stationary noise processes by Safehi (1966). In each case the purpose was to show that the probability of error for t epsilon (-T,T) converges to the probability of error for t epsilon (minus infinity, infinity). The purpose of this paper is to show that both of the results above are but special cases of a more fundamental result to be given here. Author (TAB)

**N69-37273#** Institute for Perception RVO-TNO, Soesterberg (Netherlands).
**RANGES OBTAINABLE WITH THE COMMUNICATION EQUIPMENT AN/GRC-106 (VOICE COMMUNICATION) Interim Report [AFSTANDBEREIKEN VAN DE RADIO-INSTALLATIE AN/GRC-106 (TELEFONIE). Interim Rapport]**
T. Houtgast and H. J. M. Steeneken [1968] 8 p In DUTCH; ENGLISH summary
(IZF-1968-26; TDCK-52726-3) Avail: CFSTI

The speech communication qualities of the AN/GRC-106 were investigated, with the transmitter and receiver on fixed position at distances of 40, 60, 80 and 100 km, respectively. The quality was evaluated on the basis of the intelligibility of military messages, the impression of the operators, and objective measurements. Measurements were performed at three frequencies, with three antenna systems, and at day as well as at night. The communication during daytime was found to be better than during the night. At daytime communication was maintained at all but the high frequencies up to 100 km; in the higher frequency band only up to 60 km. At the higher frequencies the whip antenna was found to be superior; at the lower frequencies the dipole antenna gave the best results. Author

**N69-37279#** Royal Aircraft Establishment, Farnborough (England).
**ON THE GENERATION OF SPURIOUS MODES IN WAVEGUIDE TRANSITIONS [ZUR ANREGUNG HOEHERER WELLENTYPEN IN HOHLLEITERUEBERGAENGEN]**
Karl Schnetzler Apr. 1969 27 p refs Transl. into ENGLISH from A.E.U. (Germany), v. 14, no. 10, Oct. 1960 p 428–431
(RAE-LIB-TRANS-1341) Avail: CFSTI

Formulae are derived for calculating the coefficients of generation of the spurious modes in a gradual waveguide transition, including the case in which the spurious mode can propagate only in part of the junction. Author

**N69-37286*#** Ewen Knight Corp., East Natick, Mass.
**A HORIZON SENSING VERTICALLY ORIENTED RADIOMETER ANTENNA STUDY Final Report**
Chester L. Smith and Hugh P. Taylor Cambridge, Mass. NASA Electronics Research Center Mar. 1969 227 p refs
(Contract NAS12-2001)
(NASA-CR-66238) Avail: CFSTI CSCL 09F

A satellite system antenna design suitable for observing the 5 mm emission from the oxygen of the earth's atmosphere in order to obtain a vertical sense is presented. An approach capable of reducing the uncertainty in the vertical error to less than 1 arc minute (3 sigma) is discussed. A trade-off analysis between performance and system complexity is included. It is shown that a significant simplification in complexity can be realized if the accuracy goal is increased to 2–3 arc minutes (1 sigma) of error. The antenna performance requirements are discussed with reference to the performance requirements imposed on the other major subsystems of the earth vertical sensor, particularly the radiometric receiver and the measurement coordinate system. Author

**N69-37409#** Polytechnic Inst. of Brooklyn, N.Y.
**SYNTHESIS OF NETWORKS OF CASCADED COMMENSURATE TRANSMISSION LINES AND SHUNT IMAGINARY RESISTORS**
Veikko Porra Helsinki Helsinki Univ. [1969] 9 p refs Sponsored by US Dept. of State
(Rept-S-27-1969) Avail: CFSTI

A narrow-band equivalent circuit to a network of cascaded unit-length lossless transmission lines and shunt lumped lossless elements between them is obtained by replacing the lumped elements by imaginary resistors. In this preliminary report the realizability conditions to the driving point and transfer functions of this new network type are derived. In addition, different rational approximation functions to an ideal filter curve are given. Author (ESRO)

**N69-37410#** Helsinki Univ. (Finland). Radio Lab.
**PROGRESS IN RADIO SCIENCE IN FINLAND, 1966–1968**
M. E. Tiuri ed. [1969] 10 p refs
(Rept-S-29-1969) Avail: CFSTI

Researches reported to the Finnish National Committee of the International Scientific Radio Union (URSI) during the period 1966–1968 are summarized for each of the 7 URSI commissions. Major topics include radio aurora, decametric radiation from Jupiter, and ionospheric disturbances induced by artificial satellites. ESRO

**N69-37509#** Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).
**REPORTS, NEWS, AND BOOK REVIEWS, VOLUME 18, NUMBER 1 [NOTE, RECENSIONI E NOTIZIE, VOLUME 18, NUMERO 1]**
Feb. 1969 174 p refs In ITALIAN; ENGLISH summaries
Avail: CFSTI

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**N69-37507#** Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).

**ACOUSTICAL EFFECTS OF SMALL FREQUENCY SHIFTS ON MUSICAL SIGNALS: GENERAL CONSIDERATIONS [EFFETTI ACUSTICI DELLE PICCOLE TRASLAZIONI DI BANDA NEI SEGNALI MUSICALI: CONSIDERAZIONI GENERALI]**

Ruggero Calicchia *In its* Rept., News and Book Rev., Vol. 18, No. 1 Feb. 1969 p 29-32 In ITALIAN; ENGLISH summary (See N69-37506 22-07)
Avail: CFSTI

In this paper three research works concerning the effect of frequency shifts on musical signals transmitted by carrier frequency systems are presented. Author (ESRO)

**N69-37508#** Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).

**STUDY OF ERROR EFFECTS IN FREQUENCY RESTITUTION ON THE QUALITY OF TYPE-A AUDIOFREQUENCY TRANSMISSION CIRCUITS [STUDIO DELL'EFFETTO DELL'ERRORE NELLA RESTITUZIONE DELLE FREQUENZE SULLA QUALITA' DI UN CIRCUITO PER TRASMISSIONI RADIOFONICHE DI TIPO A]**

Giorgi Benassi and Oliviero Cottatellucci *In its* Rept., News and Book Rev., Vol. 18, No. 1 Feb. 1969 p 33-41 In ITALIAN; ENGLISH summary (See N69-37506 22-07)
Avail: CFSTI

Subjective determinations, based on opinion tests, of music and speech programs impaired by errors in the reconstituted frequencies are described. A degree of harmonic distortion was introduced to investigate the interaction between the two types of disturbance. Positive and negative frequency errors were tested in order to search for error sign influence on quality impairment. It was concluded that, in practice, frequency shifts up to 4 Hz are not noticeable by average observers. Author (ESRO)

**N69-37509#** Fondazione Ugo Bordoni, Rome (Italy).

**DETERMINATION OF THRESHOLD DISCRIMINATION OF FREQUENCY RESTITUTION ERROR IN TYPE-A MUSICAL AUDIOFREQUENCY CHANNEL [DETERMINAZIONE DELLA SOGLIA DI DISCRIMINAZIONE DELL'ERRORE NELLA RESTITUZIONE DELLE FREQUENZE IN UN CANALE RADIOFONICO MUSICALE DI TIPO A]**

Foster Bianchi and Giovanni Ibbe *In* Ist. Super. Poste e Telecomun. Rept., News and Book Rev., Vol. 18, No. 1 Feb. 1969 p 42-57 In ITALIAN; ENGLISH summary (See N69-37506 22-07)
Avail: CFSTI

An analysis has been made of the transmission quality of a type 'A' program channel affected by errors in frequency restitution. Subjective tests were carried out to determine both the detection threshold of errors and the reliability of the results. It was found that, in case of standard listening, the detection threshold of error is equal to about ± 4Hz. Author (ESRO)

**N69-37510#** Radiotelevisione Italiana, Milan (Italy).

**EXPERIENCES IN THE AUDITIVE PERCEPTIBILITY OF SMALL FREQUENCY SHIFTS IN MUSICAL SIGNAL SPECTRA [ESPERIENZE SULLA PERCETTIBILITA AUDITIVA A PICCOLE TRASLAZIONI IN FREQUENZA DELLO SPETTRO DI UN SEGNALE MUSICALE]**

V. Guenziroli, V. Monaco (Bologna Univ.), and G. Vannucchi (Soc. Telettra) *In* Ist. Super. Poste et Telecomun. Rept., News and Book Rev., Vol. 18, No. 1 Feb. 1969 p 58-71 In ITALIAN; ENGLISH summary Submitted for publication (See N69-37506 22-07)
Avail: CFSTI

In the transmission of sound signals in a frequency division multiplex all the components of the frequency spectrum may be changed by a small amount depending on the stability of the carrier generators. Tests have ben carried out to investigate the subjective effect on different listeners of shifting the frequency of high-quality sound signal. It is concluded that the limit of frequency shift must be extremely small for high quality sound signals. Author (ESRO)

**N69-37602*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

**APPLICATIONS OF ANALYTIC FUNCTION THEORY TO ANALYSIS OF SINGLE-SIDEBAND ANGLE-MODULATED SYSTEMS**

John H. Painter Washington Sep. 1969 42 p refs
(NASA-TN-D-5446) Avail: CFSTI CSCL 17B

The theory and notation of complex analytic time functions and stochastic processes are applied to the investigation of the single-sideband angle-modulation process. Low-deviation modulation and linear product detection in the presence of noise are carefully examined for the case of sinusoidal modulation. Modulation by an arbitrary number of sinusoids or by modulated subcarriers is considered. Also treated is a method for increasing modulation efficiency. An examination of the asymptotic (low-noise) performance of nonlinear detection of a single-sideband carrier which is heavily frequency modulated by a Gaussian process is discussed. Author

**N69-37627#** Lowell Technological Inst. Research Foundation, Mass.

**AUTOMATIC PROCESSING OF INFRASONIC DATA**

Adolph Baker and Bodo W. Reinisch Feb. 1969 55 p refs
(Contract AF 19(628)-5820)
(AD-689182; LTIRF-293/IP; AFCRL-69-0110) Avail: CFSTI CSCL 4/1

Automatic techniques have been developed for identification of propagational modes contained in infrasonic waves. Digital Fourier analysis applied to sequential time windows resolves the signal in the period (or frequency) and time domain. Computerized mapping of isobaric contour lines in the time-period plane reveals the different modes of propagation. A Wiener-Hopf filter, used in communication theory for filtering noise by minimizing the mean square error with respect to a desired spectrum, has here been extended to include mode filtering as well as noise suppression. The undesired normal modes have been treated as event-independent noise, resulting in a digital filter process which extracts a particular mode from the complex infrasonic signal. Author (TAB)

**N69-37629#** Michigan Univ., Ann Arbor. Radiation Lab.

**SCATTERING BY A SPHERICAL SHELL WITH A CIRCULAR APERTURE**

Seichoong Chang and Thomas B. A. Senior Apr. 69 149 p refs
(Contract F19628-68-C-0071)
(AD-689188; SR-5; AFCRL-69-0203) Avail: CFSTI CSCL 17/4

The electromagnetic scattering behavior of a spherical shell with a circular aperture was studied. The shell was assumed to be perfectly conducting and infinitesimally thin, and was illuminated by a plane wave symmetrically incident upon the aperture. The application of the method of least square error, as well as of a

modified version is fully discussed. The modification consists of the seperating out of the appropriate surface field behavior near to the edge of the aperture, and was carried out to overcome the slow convergence and marginal accuracy of the original approach. The marked improvement provided by the modification is clearly evident. The numerical study was limited to the frequency range corresponding to 0.5Lor=ka Lor=4.85, where a is the radius of the spherical shell, and numerical values of the backscattering cross sections for the aperture angle theta sub o=30 degrees and 90 degrees, as well as for the tangetial field components over the boundary surface for theta sub 0=30 degrees, are presented. To verify these results and to obtain more physical insight into the scattering behavior, experimental measurements of the backscattering cross sections for theta sub o=15, 30, 45, 60 and 90 degrees, and of the current components for theta sub o=30 degrees, are obtained using two sets of spherical shell models. It is observed that a spherical shell with aperture-on incidence has, in general, a higher backscattering cross section than a solid sphere except at values of ka near to the cavity resonances, where marked reductions occur. A comparison of the numerical and experimental results is made. Author (TAB)

**N69-37637#** General Dynamics Corp., Groton, Conn. Electric Boat Div.

**PROCESSING OF DATA FROM SONAR SYSTEMS. SUMMARY OF WORK PERFORMED**

Peter M. Schultheiss 1 Apr. 1969 23 p refs

(Contract N00014-68-C-0392)

(AD-689201; U417-69-044) Avail: CFSTI CSCL 17/1

A summary is given of analytical studies concerned with sonar signal processing. Both active and passive sonar problems were considered, although the major effect concentrated on passive sonar. The early emphasis was on detection. Current work in passive sonar is evenly divided between a continuing program studying detection problems and recently initiated studies dealing with bearing estimation topics. Problems which have been considered and general results obtained are outlined and briefly discussed. Author (TAB)

**N69-37698*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**THE PULSE-POSITION-MODULATION TELEMETRY VIDEO MONITOR**

R. K. Kopsidas, R. J. Stattel, P. L. Hinds, and L. T. Davis Jul. 1969 40 p refs

(NASA-TM-X-63665; X-721-69-314) Avail: CFSTI CSCL 17B

The video monitor is part of the pulse-position-modulation telemetry ground station of Goddard Space Flight Center. It is used to display certain waveforms that are useful in adjusting the station equipment. It is so designed and so connected to the station equipment that, by the turning of one control, the operator is able to select a particular waveform, the portion of it to be viewed, and the best sweep length for displaying it. Author

**N69-37731#** Joint Publications Research Service, Washington, D.C.

**INADEQUACIES OF SOVIET RADIO TERMINOLOGY DISCUSSED**

V. F. Pchelkin et al 16 Sep. 1969 6 p refs Transl. into ENGLISH from Radiotekhn. (Moscow), no. 7, Jul. 1969 p 107-109

(JPRS-48820) Avail: CFSTI

An attack on the inadequacies of Soviet radio emission and reception terminology is explained. The deficiencies are listed as: (1) fixed meaning of radio-technical terms do not have fixed meanings throughout the literature; (2) abbreviations for radio-technical dimensions and characteristics terms do not exist or unapproved forms are applied; (3) the requirements of a single standard of units of measurement, such as megahertz which should be written as "Mgts" in Russian italics but is used as "mggts" and "mgts"; (4) insufficient definition and limitation of terms, leading to a profusion of synonym terms; (5) unrestricted use of homonyms; (6) the construction and use of new terms without strict definition; and (7) ambiguity and distortion of meaning due to lack of uniformity in English-to-Russian translation. Classification of radio-wave ranges and frequencies based on the very strict Radio Communication Regulations (Geneva, 1959) is recommended. M.H.E.

**N69-37735#** European Space Vehicle Launcher Development Organization, Paris (France).

**DIRECT TV BROADCASTING FROM SATELLITES**

M. Gill and S. Hieber Jun. 1969 25 p refs partly in ENGLISH and partly in FRENCH; ENGLISH summary

(ELDO-TM-119) Avail: CFSTI

Broadcasting of television programs from a geostationary satellite directly to home receivers seems to be a short-term possibility despite the major technical, administrative and political problems that would need to be resolved. The report is divided into two parts: Part A (telecommunications aspects) reviews the major parameters which contribute to the performance of the communication link. After definition of a set of representative parameters for a selected mission its satellite transmitter power is established; Part B (technological aspects) discusses the primary subsystems of the satellite system and describes the principles of a possible satellite configuration as well as the technological aspects. Author (ESRO)

**N69-37744#** Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.

**AN ANALYSIS OF LATERAL ECHO-SOUNDER RECORDS TAKEN ABOARD THE BATHYSCAPH ARCHIMEDE**

J. Brakl, C. S. Clay, W. Liang, and G. Fisher Apr. 1969 31 p refs

(Contract Nonr-266(94))

(AD-689743; TR-170; CU-198-69-ONR-266-Phys) Avail: CFSTI CSCL 13/10

A lateral echo-sounding sonar, developed at Hudson Laboratories in 1963, was modified to fit into the compact sphere of the French bathyscaph Archimede. This lateral echo-sounder proved to be a valuable aid to visual observations of the Puerto Rico Trench during dives by the bathyscaph. The visibility during these dives was often hampered by ambient poor visibility and muddy turbulence created by the bathyscaph. This report presents some interpretations and correlations between the side-looking sonar records, and visual observations from the bathyscaph taken during the dives under Project DEEPSCAN. Author (TAB)

**N69-37802#** Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).

**ORIGIN, DEVELOPMENT AND PRESENT STATE OF THE TECHNIQUE OF INTEGRATED TRANSMISSION-SWITCHING TELEPHONE NETWORKS [ORIGINI, SVILUPPO ED ESTATO ATTUALE DELLA TECNICA DEI SISTEMI TELEFONICI INTEGRATI]**

Odoardo Brugia (Fondazione Ugo Bordoni, Rome) Oct. 1968 151 p refs in ITALIAN; ENGLISH summary *Its* Note, Recensioni, Notiz., Vol. 17, Suppl. to No. 5

Avail: CFSTI

The first part of this report deals with the basic design problems of integrated telephone networks and outlines the most suitable solutions proposed or built up to the present. The fundamentals of digital modulation and time division techniques, which are involved in the concept of switching and transmission integration, are recalled with emphasis on PCM applications to integrated networks. The choice criteria of the most significant parameters of PCM/TDM primary multiplex are supplied, and the specifications of these parameters, stated or planned by national administrations or international bodies as CCITT and CEPT are discussed in detail. Other topics as signalling and network synchronization methods suited for integrated techniques are also covered, as well as the problems regarding switching network

structure and organization, interconnectibility among integrated systems, and compatibility with pre-existing electromechanical networks. The second part describes the equipment and principles of operation of some integrated systems such as EMAX 300, SINTEL, and Pleton. Features of the integrated networks planned by English, Swiss and Australian administrations are also outlined. The third part covers the relevant historical background of the development of integrated techniques in several countries, and discusses the policy followed by national administrations in co-ordinating research and manufacturing activities devoted to the problems of integrated networks and electronic switching. The paper also provides a bibliography, with more than 700 entries covering the period 1949-1968. Author (ESRO)

**N69-37810#** Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
**OPERATIONAL IN-LINE LISTENING ARRAY**
Edward T. O'Neill Apr. 1969 22 p
(Contract Nonr-266(84))
(AD-688748; TR-177; CU-205-69-ONR-Phys) Avail: CFSTI CSCL 17/1

A description of the details of an in-line hydrophone preamplifier operational array is given. Author (TAB)

**N69-37823#** University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
**POLYNOMIAL REPRESENTATION OF DIFFRACTION FIELDS AT CRUSTAL IRREGULARITIES Final Report, 1 Dec. 1967 - 1 Dec. 1968**
Julius Kane, Tejendra Nath Maulik, and Eugene Denman Jan. 1969 33 p ref
(Contract F19628-68-C-0168)
(AD-689436; USCEE-361; AFCRL-69-0079) Avail: CFSTI CSCL 20/14

By means of the Lanczos tau method, polynomial representations are found for the transverse variation of modal solutions of the wave equation. This limits the transverse variation to a finite number of degrees of freedom. While restricted to a finite number, the accuracy in representing modal variation is highly satisfactory, particularly for the lower order modes. Furthermore, major computational advantages materialize in the succeeding analysis. Contour integral representations of solutions of the approximate wave equation no longer involve branch cut integrations-- the only singularity being a family of poles at plus or minus k where k is the propagation constant within the waveguide. Accordingly, Weiner-Hopf problems can be solved almost by inspection inasmuch as the kernel to be factored is a rational function with explicitly displayed poles and zeros. Explicit formulas are given for the entries in the scattering matrix that describes the junction of two dissimilar waveguides. Author (TAB)

**N69-37877#** Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
**INERTIALESS ELECTRONIC GEODESIC SCANNER Final Technical Report, 17 Oct. 1966 - 16 Dec. 1968**
R. P. Zimmer, M. E. Wallace, and F. O. Herschelman May 1969 87 p refs
(Contract DAAH01-67-C-0463)
(AD-689502; GIT-A-980-F) Avail: CFSTI CSCL 17/9

The design parameters for a practical X-band electronic 360 degree scanning antenna have been evolved. The antenna employs two geodesic Luneberg lenses and a secondary radiator in conjunction with a switching network consisting of latching circulators arranged in a tree-type configuration. The general technique also is applicable to a sector scan system. A complete mechanical layout has been made of a typical model with the following theoretical characteristics: an azimuth beamwidth of 3.8 degrees, an adjacent beam overlap of 2 dB, an insertion loss of less than 3 dB, a peak power handling capability of 20 KW minimum, and an average power capability in excess of 100 watts. This type of scanning antenna has the advantage that the gain, beamwidth, side-lobe level, and cross-over points of adjacent beams are constant with scan angle. In addition, the beam positions are stable because they are determined by the mechanical position of the feeds and consequently are insensitive to changes in operating conditions. Author (TAB)

**N69-37922#** Army Foreign Science and Technology Center, Washington, D.C.
**THE TRANSMITTING CAPACITY OF MEASURED SYSTEMS IN TRANSMITTING A MULTIDIMENSIONAL SIGNAL WITH CORRELATED COMPONENTS**
A. N. Svenson et al. Feb. 1969 11 p refs Transl. into ENGLISH from Russian conf. proc.
(AD-688176; FSTC-HT-23-365-68) Avail: CFSTI CSCL 17/2

This translation deals with the theoretical and practical aspects of raising the efficiency of multichannel systems of information transmission. This is done through a fuller utilization of the statistics of instantaneous values of transmitted signals. Also included is the method of multichannel time-pulse modulation. Changing the duration of channel intervals according to the instantaneous values of the transmitted signal is used to increase the systems number of channels. Author (TAB)

**N69-38073*#** Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
**CHARACTERISTICS AND PROCESSING OF FPS-16/JIMSPHERE RAW RADAR DATA**
R. E. De Mandel and S. J. Krivo NASA. Marshall Space Flight Center May 1969 73 p refs Prepared for Northrop Corp.
(Contract NAS8-20082)
(NASA-CR-61280; LMSC/HREC-D148864; TM-64/50-128) Avail: CFSTI CSCL 17/1

The characteristics of FPS-16/jimsphere raw radar measurements are illustrated and discussed. Errors in these measurements, resulting from faulty data processing, aerodynamic balloon motions and radar performance, are evaluated in terms of their effect upon the accuracy of computed 25-meter wind values. Wind errors resulting from aerodynamic motions are shown to be insignificant. Stray points and data shifts, which are thought to be incurred during preprocessing of radar tapes, are not always removed by NASA's present editing method and may cause significant errors in computed winds. Slow radar response to changes in the position of the balloon, coupled with the effect of aliasing when 0.1-second radar measurements are converted to 25-meter wind values, may also cause significant errors in computed winds. Recommendations are made, directed toward preventing and eliminating significant types of error. Author

**N69-38130#** Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).
**DELAY LINE IN PAL DECODERS. THEORETICAL CONSIDERATIONS AND EXPERIMENTAL RESULTS [LA LINEA DI RITARDO NEI DECODIFICATORI PAL CONSIDERAZIONI TEORICHE E RISULTATI SPERIMENTALI]**
L. Bencini and G. Morganti (Fondazione Ugo Bordini, Rome) *In its* Rept., News and Book Rev., Vol. 17, No. 4 Aug. 1968 p 685-698 In ITALIAN; ENGLISH summary (See N69-38128 22-34)
Avail: CFSTI

This paper deals with distortions on reproduced pictures and on electric signals produced by errors of delay line length in PAL decoders. Effects on picture quality are evaluated by the subjective assessments of non-expert observers. Test modalities are summarized. Author (ESRO)

**N69-38168#** Ohio State Univ. Research Foundation, Columbus.
**THE SYNCHRONIZATION OF TIME DIVISION MULTIPLE ACCESS: AN ANALYTICAL AND EXPERIMENTAL STUDY**
R. J. Huff, K. L. Reinhard, and D. C. Lipp Griffiss AFB, N.Y. RADC May 1969 88 p refs

(Contract F30602-67-C-0119)
(AD-689223; OSURF-2358-9) Avail: CFSTI CSCL 17/2

A complete technology for synchronizing the transmissions in time division multiple access (TDMA) systems is presented. Up-link synchronizers are described which employ two coupled sampled-data delay-lock loops to provide the time base tracking functions. A sampled-data delay-lock loop is also used to provide down-link (bit) synchronization. Linearized models of the synchronizers are used to develop expressions relating the timing errors to signal and system parameters. Both deterministic errors due to clock frequency offsets and to relative satellite/terminal motion and random errors due to noise are investigated. The results apply to a relatively general network model, since few restrictive assumptions are employed in the analyses. An experimental synchronizer implemented to demonstrate concept feasibility and to check the accuracy of analytical results is described. The experimental results obtained by both bench and IDCSP satellite link testing are given. Based on these results, an assertion is made that the analytical results can be used with confidence in the design of operational TDMA systems. Author (TAB)

N69-38163# Boeing Scientific Research Labs., Seattle, Wash. Information Sciences Lab.
**STATE ESTIMATION IN SYSTEMS CONTAINING SERIALLY CORRELATED MEASUREMENT NOISE**
Frederick C. Johnson May 1969 16 p refs
(AD-689658; D1-82-0849; ISR-29) Avail: CFSTI CSCL 9/4

The techniques of recursive least squares analysis are applied to the state estimation problem for systems which contain both dynamic noise and serially correlated measurement noise. Generalized filter equations are obtained, and special cases of these equations which are suitable for real-time applications are considered. Author (TAB)

N69-38189# Michigan Univ., Ann Arbor.
**A SURVEY OF PICTORIAL DATA-COMPRESSION TECHNIQUES**
Jack Di Ginseppe Mar. 1969 65 p refs
(Contract DA-49-083-OSA-3050; ARPA Order 716)
(AD-689859; TR-16) Avail: CFSTI CSCL 9/2

The results of a survey of pictorial data-compression techniques are summarized in this report. The survey was motivated by a study of half-time graphics communication over voice grade lines. The principal compression techniques surveyed include the following: the optimization of the parameters of ordinary pulse coded modulation, pulse coded modulation using added pseudo-random noise, differential pulse coded modulation, predictive differential pulse coded modulation, run-length encoding, brightness edge detection and the use of synthetic highs, brightness contour detection and encoding, area encoding, picture compression in the Fourier domain. Author (TAB)

N69-38213# Lincoln Lab., Mass. Inst. of Tech., Lexington.
**ON A CLASS OF ORTHOGONAL SEQUENCES**
Brian E. White 4 Jun. 1969 44 p refs
(Contract AF 19(628)-5167)
(AD-689552; ESD-TR-69-153; TN-1969-23) Avail: CFSTI CSCL 9/4

The work was motivated by studies proposing the use of binary continuous-phase frequency-shift-keying (FSK) [with a frequency spacing of 1/2T, where T is the signalling interval corresponding to one data bit] for high-power low-frequency communications in military applications. Of interest here are mutually orthogonal N-ary continuous-phase FSK waveforms composed from mutually orthogonal signals equally spaced in frequency by any odd number of half cycles per signalling interval T. Author (TAB)

N69-38239# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
**A SYSTEMS SOLUTION TO THE TECHNICAL AND OPERATIONAL PROBLEMS CONFRONTING AN INTERNATIONAL EDUCOM AND COMPUTER NETWORK SYSTEM UTILIZING SATELLITE COMMUNICATIONS : Annual Report, Period Ending 30 Apr. 1969**
Richard Thomas Shearer (M.S. Thesis) Feb. 1969 117 p refs
(Contract ONR-N0014-67-A-0214-0003)
(AD-689124) Avail: CFSTI CSCL 17/2

The study concerns a real time, on line, duplex data processing global communications systems. It establishes the system cost-effectiveness and feasibility of a multi-satellite global service. Service could be offered to 128 users at data rates up to 250,000 bits per second with bit error probably 1 one part in 100,000 using powered battery pack electronics and a two foot terminal antenna. Equivalently duplex computer to computer simultaneous service is competitive and feasible. Author (TAB)

N69-38263# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**PROBLEMS OF THE STATISTICAL THEORY OF RECOGNITION**
Yu. L. Barabash, B. V. Varskii, V. T. Zinoviev, and V. S. Kirichenko Dec. 1968 318 p refs Transl. into ENGLISH from the Russian
(AD-690237; FTD-HT-23-657-68) Avail: CFSTI CSCL 6/4

The book is devoted to the recognition of random objects and phenomena of a distinctive physical nature. The fundamentals of the statistical theory of recognition and consideration of the practical application of this theory are discussed. The analysis of recognition models encompasses a wide range of problems such as the definition of classes, characteristics, solution criteria, of the recognition process, structure of recognition systems and special theory applications. The analysis is accompanied by numerical examples. Considerable attention is paid to the recognition of images, radio signals, sounds of speedy weather prognosis, and medical diagnosis. The community of models makes it possible to utilize the methods developed in other fields. TAB

N69-38414# Institute for Telecommunication Sciences and Aeronomy, Boulder, Colo.
**TABULATIONS OF PROPAGATION DATA OVER IRREGULAR TERRAIN IN THE 230-TO 9200-MHZ FREQUENCY RANGE. PART 2-FRITZ PEAK RECEIVER SITE**
P. L. Mc Quate, J. M. Herman, M. E. Johnson, and A. P. Barsis Dec. 1968 191 p
(AD-689708; ITS-58-2) Avail: CFSTI CSCL 17/2.1

The report is the second part of a four-part report series containing tabulations and graphs of transmission loss data resulting from propagation experiments in the 230- to 9200- MHz frequency range conducted over irregular terrain in Colorado. This part describes data obtained at a single common receiver site at Fritz Peak, Colorado, over propagation paths varying in length from 3.0 to 120 km. Author (TAB)

N69-38519# Texas Univ., Austin. Electronics Research Center.
**ON A GENERAL RELATIONSHIP BETWEEN ESTIMATION, DETECTION AND THE BHATTACHARYA COEFFICIENT**
Demetrios G. Lainiotis 22 Apr. 1969 11 p refs
(Grants AF-AFOSR-0766-67; AF-AFOSR-1764-68)
(AD-690-137; TM-9; AFOSR-69-1023TR) Avail: CFSTI CSCL 9/4

A general and fundamental relationship between estimation, detection/pattern recognition and the Bhattacharya coefficient is established. Specifically, it is shown that a functional of the likelihood ratio necessary for Bayes optimal detection/pattern recognition is the Bayes-optimal mean-square estimate of the indicator variable beta, where beta = 1, 0 for hypothesis H sub 1, H sub 0, respectively. The Bhattacharya coefficient is then shown to be the expected value of the estimation error standard deviation. Author (TAB)

# 08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-37203# Naval Postgraduate School, Monterey, Calif.
**OBJECTIVE DIGITAL ANALYSIS OF BATHYTHERMOGRAPH TRACES**
Eric Francis Grosfils (M.S. Thesis) Dec. 1968 127 p refs
(AD-689121) Avail: CFSTI CSCL 8/10

There is a need for a fast method of analyzing bathythermograph traces and this need is approached by the means of a high-speed digital computer. The theory behind the computer program is outlined. Both synthetic and real data cases are run as examples using both data card decks and magnetic tape inputs. The program has been designed to read digitized bathythermograph traces and then analyze them objectively by Gaussian and non-Gaussian methods for the top, center, and base of the main thermocline. Additionally, such features as multiple thermoclines, inversions, and thermal transients are identified also and their key points are included in the informational data printout.
Author (TAB)

N69-37236# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Speech Communications.
**THE STL COMPUTER INSTALLATION**
J. Liljencrants *In its* Speech Transmission Lab. 15 Apr. 1969 p 1–6 refs (See N69-37235 22-04)
Avail: CFSTI

A summary description of the hardware for the CDC 1700 computer system installed to assist in laboratory speech compression studies is provided. Attention is also given to user system programs and operating methods. A special monitor system was developed which heavily relies on the disk storage used both for data working storage and the program library; this modification was necessary since the operating system supplied with the machine was not well suited for unconventional laboratory procedures. Programs are also written directly in machine code, an advantageous practice as the number of typed characters required for program definition is less than half that necessary using assembly language. In addition, the assembly and source program editing processes can also be eliminated.
A.C.R.

N69-37237# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Speech Communications.
**SPECTRUM ANALYSIS USING THE FAST FOURIER TRANSFORM (FFT)**
J. Liljencrants *In its* Speech Transmission Lab. 15 Apr. 1969 p 7–13 refs (See N69-37235 22-04)
Avail: CFSTI

As part of a general speech analysis computer program, a spectrum analysis package using the fast Fourier transform was implemented. The input is present as a time series of periodic samples from the signals. After application of a suitable time window, the corresponding discrete Fourier transform is computed and the spectral magnitude determined. Specific problems involving the application of the technique are treated, giving particular attention to an important limitation on the time window imposed by the sampling theorem. A dual sampling theorem may thus be formulated, the effect of which does not appear to be generally recognized.
Author

N69-37244# Air Force Logistics Command, Wright-Patterson AFB, Ohio. Operations Analysis Office.
**RGM-1: EXECUTIVE SUMMARY Operations Analysis Report**
Jay F. Williams Jun. 1969 27 p refs
(AD-688823; OAR-9) Avail: CFSTI CSCL 15/5

The RGM 1 is a life cycle cost model that determines the optimum combination of logistic resources and repair activities for the correction of malfunctions of a hardware system. The model relates the engineering description of the hardware system, and the cost structure and capabilities of the Air Force logistics system, and identifies the repair activities and placement of logistics resource that will maintain the hardware system for the utilization program at a minimum overall cost. The RGM 1 supplies a logical and consistent procedure for determining repair requirements, establishing repair prodedures, identifying the resources required, and estimating the life cycle costs involved in hardware support.
TAB

N69-37245# Illinois Univ., Urbana. Coordinated Science Lab.
**GENERATION OF DIAGNOSTIC TESTS USING PRIME IMPLICANTS**
Michael Reid Page May 1969 43 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-1663)
(AD-688832; R-414) Avail: CFSTI CSCL 9/2

With recent advances in microminiaturization and fabrication techniques, digital computer design has begun to make fuller use of single packages containing many logic gates. This change in design approach has shifted the emphasis in fault testing techniques. Fault Testing is defined here as the process of determining whether or not a package of gates is operating correctly by comparing its output under certain inputs with that of the fault-free machine. It is the purpose of this thesis to present an approach to fault testing using only the prime implicant information provided for the system. This technique is an answer to the question, How may fault tests for a given circuit be selected with the minimum of detailed analysis of the logic network. The number of tests specified by this approach is, in general, much lower than the number of possible input combinations, although it may be higher than the minimum number of tests which could be derived with full, detailed knowledge of the circuit structure.
Author (TAB)

N69-37264# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
**MAO**
Arnold Rom Apr. 1969 26 p refs *Its* Mathematical Note No. 598
(AD-688109; D1-82-0840) Avail: CFSTI CSCL 9/2

A software package is described which is applicable to a large class of problems in the fields of astrodynamics and nonlinear mechanics. The package enables its user to perform algebraic operations on a computer. The routines are coded for the IBM 360/44 and can be called from FORTRAN.
Author (TAB)

N69-37265# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
**REAL ENGLISH: A TRANSLATOR TO ENABLE NATURAL LANGUAGE MAN-MACHINE CONVERSATION Interim Report**
Harvey Cautin May 1969 175 p refs
(Contract AF 49(638)-1421)
(AD-689280; AFOSR-69-1481TR) Copyright. Avail: CFSTI CSCL 5/2

This dissertation presents a pragmatic interpreter/translator called Real English to serve as a natural language man-machine communication interface in a multi-mode on-line information retrieval system. This multi-mode feature affords the user a library-like searching tool by giving him access to a dictionary, lexicon, thesaurus, synonym table, and classification tables expressing binary relations as well as the document file representing the field of discourse. The user is thereby allowed a greater freedom in search strategy. Real English will (1) syntactically analyze the users message by means of a strong analysis grammar to produce a tree representing the interrelationships of the grammatical entities comprising the message, (2) use this tree together with a pragmatic grammar to establish the set of commands necessary to fulfill the request, and (3) form the proper syntax for each command. The strong linguistic foundation of the syntax analyzer endows the system with the power of flexibility. As experience shows that

certain new structures occur and should therefore be a part of the system, they may be incorporated into the system by the grammarian without a major overhaul of the procedures to date. The user is permitted to phrase his requests in any convenient form (i.e. declarative, imparative, interrogative, or fragmented sentence referred to as conversationally dependent sentences). Thus, instead of placing the user in the difficult position of learning a new language, the system is given the responsibility of responding in and to the users language, i.e. the man-machine conversation is carried out in a natural language. Author (TAB)

**N69-37276#** California Univ., Los Angeles. Dept. of Engineering.
**DIGITAL TECHNOLOGY RESEARCH Final Technical Report, 1 Jun. 1958 – 31 May 1968**
Oct. 1968 23 p refs
(Contract Nonr-233(52))
(AD-688197) Avail: CFSTI CSCL 9/2

The scope of research activity under this contract included studies of computer languages, translators, organization, arithmetic, control, components, applications and related physical phenomena. The highlights of research results are outlined. A list of papers and reports published with support of this research contract is given. TAB

**N69-37301#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**USE OF STRUCTURAL RESERVES FOR INCREASING THE RELIABILITY OF AUTOMATIC DEVICES**
E. N. Turuta 5 Feb. 1969 16 p refs Transl. into ENGLISH from Acad. Sci. USSR, Siberian Dept., Inst. Math., Computer Systems, Collection of Works (Moscow), no. 25, 1966 p 19 – 30
(AD-688095; FTD-HT-23-863-68) Avail: CFSTI CSCL 9/2

The paper discusses a finite automan with the state set presented in the form of a system consisting of a combinational logic circuit and memory elements. Random malfunctions of the following type may occur in the logic elements and memory elements: an element that must issue 1 at the output issues 0 instead, and vice versa. The satisfaction of the following conditions is presumed: the probability of the distortion of the input signal of any memory element is low; the errors of various memory elements are independent and their probabilities p are the same for every element and do not vary in time and, further, p is greater than 1/2. To enhance the probability of correct transition, h additional memory elements are introduced into the automation and k of its states are encoded in the words of some code having the length n equals k plus h with k information symbols and h redundant symbols. All the binary sequences x of the length n that do not coincide with any of the code words are termed distorted states of the automation. TAB

**N69-37318#** Cornell Univ., Ithaca, N.Y.
**SOME EXPERIMENTS ON TOBERMORY MEMORY PERFORMANCE**
Stephen Jon King *In its* Cognitive Systems Res. Program. Collected Tech. Papers, vol. 3 30 Jun. 1968 p 33 – 45 (See N69-37315 22-05)
Avail: CFSTI

The characteristic nonlinear response of Tobermory's analog cores to reinforcement is investigated. Experimental results were also compared to computer simulations of Tobermory's operations in conditions of ideal and nonideal weights. Running the system as a simple three layer perceptron, twenty-two iterations with error correction were processed. Nonlinearity of the weights was demonstrated but this finding was not adequate to explain both noise and preprocessors problems in Tobermory's memory response. Hardware techniques were advised to correct the noise problems prior to additional training and/or further experiments. M.H.E.

**N69-37319#** Cornell Univ., Ithaca, N.Y.
**SOME INVESTIGATIONS OF C-SYSTEMS AND RELATED NETWORKS**
David A. Petty *In its* Cognitive Systems Res. Program. Collected Tech. Papers, vol. 3 30 Jun. 1968 p 47 – 62 refs (See N69-37315 22-05)
Avail: CFSTI

The $I^{\circ}$ (conventional) and $I^{+1}$ type C-systems are analyzed as to probability of correct response of an A-unit during recall. The $I^{\circ}$-reinforcement scheme is shown to offer greater resistance to random variations in A unit firing frequencies. The performance of a simple percaptron with its A layer coupled to a C layer can be predicted knowing the above probabilities, and explicit expressions are derived for this purpose. The possibility of overwriting previously learned associations in the C system is demonstrated, and the amount of reinforcement during overwriting, necessary for a given level of performance, is derived. Author

**N69-37320#** Cornell Univ., Ithaca, N.Y.
**A REINFORCEMENT RULE FOR A MAJORITY DECISION NETWORK**
Carl Kesler *In its* Cognitive Systems Res. Program. Collected Tech. Papers, vol. 3 30 Jun. 1968 p 63 – 65 ref (See N69-37315 22-05)
Avail: CFSTI

Given a majority decision network of m simple R-units, where m is odd and any simple R-unit is a linear threshold logic unit with a zero threshold and a plus or minus one output. Each R-unit has a variably-weighted connection from each n component in the input vector (stimuli) and only plus or minus one vectors are used. The parity function effecting the input vectors (stimuli) is applied. Then, a reinforcement rule is developed for $m = n = 13$ which converges in the least time. A flow diagram illustrates the reinforcement rule for the network and results of computer simulation runs using the flow diagram are shown. M.H.E.

**N69-37321#** Cornell Univ., Ithaca, N.Y.
**A LINEAR REGION LOGIC UNIT**
Carl Kesler *In its* Cognitive Systems Res. Program. Collected Tech. Papers, vol. 3 30 Jun. 1968 p 67 – 78 refs (See N69-37315 22-05)
Avail: CFSTI

Contradictions in previous methods of input vector region solutions are demonstrated, and the question of the assignment of an appropriate region to any plus or minus input vector is analysed. In a linear region logic unit where + class regions are alternated with – class regions, a theorem is developed to assist in assigning regions to solvable inequalities. Computer flow diagrams demonstrate the use of the theorem in two experiments, and tables of experimental results are included. M.H.E.

**N69-37468#** Royal Aircraft Establishment, Farnborough (England).
**A PROP3 USER'S MANUAL**
R. H. Gooding and R. J. Tayler Dec. 1968 89 p refs
(RAE-TR-68299) Copyright. Avail: CFSTI

PROP3 is the third version of a computer programme for refining the orbital elements of an earth satellite. A description of the programme is given, together with full instructions on how to use it. Author (ESRO)

**N69-37480#** RAND Corp., Santa Monica, Calif.
**SOVIET CYBERNETICS: RECENT NEWS ITEMS, VOLUME 3, NUMBER 5**
Dorothy Mc Donald, ed. and Wade B.Holland, ed. May 1969 137 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-689761; RM-6000/5-PR) Avail: CFSTI CSCL 5/4

The May issue features an article on automated management information systems in which it is clearly indicated that the Soviet labor force is feeling the effects of automation. Three articles on forecasting show that prognostics is beginning to take hold in the Soviet Union and that is is being dealt with by some very prestigious scientists. Academician G. Marchuks article on the

centralized management of the computer industry reflects the thinking of Soviet leaders in computing about the USSR's needs, particularly relative to the importance of disc storage units. Hardware discussed includes the Ruta, the Masia, the M-54, and some East German machines. Other articles describe computer-assisted and computer-managed instruction in electrical engineering; automation of a heavy machine plant; conferences on industrial and general psychology and on mathematical methods in geology and hydrogeology; research at Science City and Kiev; and developed of the State Network of Computing Centers. Author (TAB)

**N69-37539#** Louisiana State Univ., Baton Rouge. Dept. of Chemical Engineering.
**FORMULATING THE NONLINEAR LEAST-SQUARE MODEL REGRESSION FOR FAST ON-LINE ANALYSIS**
Charles F. Moore, Cecil L. Smith, and Paul W. Murrill New York Am. Inst. of Chem. Engr. Mar. 1969 26 p refs Presented at 64th Natl. Am. Inst. of Chem. Engr. Meeting, Symp. on Optimization Appl., New Orleans, 16–20 Mar. 1969 Submitted for publication *Its* Preprint No. 22-D
(Contract F44620-68-C-0021)
(AD-689130; AFOSR-69-1407TR) Avail: CFSTI CSCL 9/2

Numerous techniques have been developed to adapt control systems to changes in process parameters. The most general of the techniques is via a direct model determination which consists of three steps: (1) periodic data collection; (2) determination of new model parameters from process data; and (3) updating of control parameters based on the new model parameters. This technique is very attractive in a complex system which contains numerous loops and several levels of control, all of which might be controlled by a different algorithm or strategy. In such cases a single regression program could be used in conjunction with all the loops and control level to adapt to changes in process parameters. This article will be primarily concerned with the first two steps in this approach to adaptive control. Author (TAB)

**N69-37682#** RAND Corp., Santa Monica, Calif.
**A GENERALIZATION OF SHIFT REGISTER SEQUENCE GENERATORS**
I. S. Reed and Rein Turn Jan. 1969 37 p refs
(AD-689054; P-3698) Avail: CFSTI CSCL 9/2

The paper examines the questions of the existence and the design of feedback shift-register sequence generators (FSR) capable of producing sequences with periods longer than obtained by the classical linear or nonlinear feedback shift-register techniques. This capability is achieved by cyclically modifying the effective connections in the feedback loop. A description of the behavior of the classical N-stage FSR in terms of cyclic transformations on its state space X sub N is formulated and used to analyze the behavior of the proposed generalized N-stage feedback shift-register, the (M, N)-FSR. The latter is shown to be capable of producing sequences of maximal period M(2 raised to the N power) for any M and N by cyclic application of properly chosen transformations. Author (TAB)

**N69-37714*#** Maryland Univ., College Park.
**COMPUTER PROGRAMS FOR REDUCTION OF MICROPHOTOMETER DATA**
R. A. Bell, Roger D. Bengtson, D. R. Branch, D. M. Gottlieb, and Randy Roig Oct. 1968 95 p
(Grants NGR-21-002-007; NSG-398; NSF GP-5963; NSF GP-7342; NSF GP-8698)
(NASA-CR-106926; TN-BN-572) Avail: CFSTI CSCL 09B

Five computer programs are presented which were written for analyzing the digital data from a microphotometer. Specifically, the programs serve to: (1) read the tape produced by the microphotometer, convert the data from the BCD coding of the microphotometer to the binary coding of the IBM 7094 computer, supply a listing of the data, and write a high-density copy of the converted data; (2) convert the microphotometer data to an intensity scale using laboratory calibration data; (3) check the calibration used in program 2; (4) convert the microphotometer data to an intensity scale using calibration techniques employed in stellar spectroscopy; and (5) identify lines in stellar spectra, with the input data being an estimate of the starting wavelength and dispersion, and with a data tape containing a list of lines which are expected to occur in the stellar spectrum. In addition to a listing and description of the programs, the microphotometer and the magnetic tape recorder are described. K.W.

**N69-37717#** Naval Postgraduate School, Monterey, Calif.
**EVALUATION OF THE ACCURACY OF A RELIABILITY MEASUREMENT PROCEDURE USING SIMULATION TECHNIQUES**
Kenneth Alan Huffman (M.S. Thesis) Dec. 1968 46 p refs
(AD-688460) Avail: CFSTI CSCL 14/4

The study evaluates the accuracy of an established reliability measurement procedure by computer simulation. The reliability measurement procedure assumes components fail according to an exponential failure law. This study tests the accuracy of that procedure when components obey a Weibull failure law or a log normal failure law. Author (TAB)

**N69-37738** European Atomic Energy Community, Ispra (Italy). Scientific Information Processing Center.
**COMPUTERS OF THE THIRD GENERATION AND THE LIBRARY OF THE ISPRA CENTER**
S. Capobianchi *In its* Meeting of European Librarians Working in the Nucl. Field Jun. 1969 p 36–43 (See N69-37736 22-34)
Avail: CFSTI

The application of third generation hardware and software capabilities to scientific libraries is discussed, and a general approach to such library automation is described. Included in the presentation are definitions of the integrated system concept, and hardware and software features of third generation computers, as well as a description of system application at a given library. Consideration is also given to memory size requirements, processing times, and cost factors to be analyzed when determining the advisability of adopting a mechanized system and when choosing the particular hardware and software configuration which will best meet individual library needs. A.C.R.

**N69-37739#** Euratom Atomic Energy Community, Ispra (Italy). Scientific Information Processing Center.
**THE INTEGRATED LIBRARY SYSTEM: PROGRAMMING CONSIDERATIONS**
A. Petrucci *In its* Meeting of European Librarians Working in the Nucl. Field Jun. 1969 p 45–59 (See N69-37736 22-34)
Avail: CFSTI

Various problems of automating a scientific library are discussed in relation to the programming efforts involved. As related to input considerations, four basic functions of library management are identified: acquisitions, cataloging, loan, and request for information. Due to the varied nature of publications handled by a library and the special processing required by each type, the collection was broken down into a series of groups, and the data concerning each publication is fed to the system by categories, such as classification, author, title, etc. Acquisition information is entered by modes, such as single-order, subscription, etc. Magnetic files containing all necessary data are at the system's disposal on direct access devices; the processing and maintenance of this data by the system is briefly treated. A.C.R.

**N69-37741#** European Atomic Energy Community, Ispra (Italy). Scientific Information Processing Center.
**THE USE OF MACHINE TRANSLATION IN DOCUMENTATION**
S. Perschke *In its* Meeting of European Librarians Working in the Nucl. Field Jun. 1969 p 75–88 refs (See N69-37736 22-34)
Avail: CFSTI

Applications of a Russian-English machine translation as an instrument for information and documentation are presented. Four principal points are discussed: (1) Russian-English service at the request of customers; (2) current awareness with automatic translation of tables of contents of Russian periodicals; (3) SDI with automatically-translated abstracts from Russian periodicals; and (4) automatic indexing of Russian abstracts to be used as input for an information retrieval system or as a key for SDI with user profiles. The new Russian-English system which is presently being implemented is presented. Author

**N69-37775#** Illinois Univ., Urbana. Coordinated Science Lab.
**A MODULE DIAGNOSTIC PROCEDURE FOR COMBINATIONAL LOGIC**
Theo J. Powell Apr. 1969 127 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-1663)
(AD-688743; R-413) Avail: CFSTI CSCL 9/2

A method to diagnose modules for combinational logic is presented. Included is a procedure to generate a set of detection tests for a module called the Fault Detection Procedure (FD-Procedure) and a method for generating a set of diagnostic tests for a combinational circuit of modules. The method for generating a diagnostic set of tests first finds a set of tests which detects the faults in the tool circuit, determines which faults in different modules need to be identified and generates the remaining necessary tests by an application of an exclusive - or operation to complete the diagnosis. A proof that the FD-Procedure generates a set of tests which detects all detectable faults for a module is given. The method to generate diagnostic tests always identifies every faulty module which can be identified because of the exclusive - or operation. Examples and comparisons to other approaches are given. Author (TAB)

**N69-37784#** Michigan Univ., Ann Arbor. Logic Computers Group.
**VON NEUMANN'S SELF-REPRODUCING AUTOMATA**
Arthur W. Burks Jun. 1969 113 p refs
(Contracts DA-31-124-ARO(D)-483; N00014-67-A-0181; Grant NIH GM-12236-03)
(AD-688840; TR-08226-11-T) Avail: CFSTI CSCL 9/1

John von Neumanns kinematic and cellular automaton systems are described. A complete informal description of the cellular system is presented including an explanation of the realization of logical components, the design of computer organs, the construction, destruction and movement of organs by sequences of internally originated pulses, universal computation and construction, and self-reproduction. Connections between von Neumanns automaton research and his work on computer design are brought out, and the significance of cellular arrays for biological research discussed. Author (TAB)

**N69-37785#** Illinois Univ., Urbana. Coordinated Science Lab.
**ON THE REPRESENTATION OF DIGITAL FAULTS**
Donald Ralph Schertz May 1969 72 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-1663)
(AD-688836; R-418) Avail: CFSTI CSCL 9/2

A new representation for faults in combinational digital systems is presented. Faults which are inherently indistinguishable are identified and combined into classes. The behavior of the circuit under fault conditions is represented in terms of these classes. This results in a description of the faulty circuit by means of Boolean equations which are readily manipulated for the purpose of test generation or fault simulation. A connection graph interpretation of this fault representation is discussed. Heuristics methods for the selection of efficient tests without extensive computation are derived from these connection graphs. The fault classes form a geometric structure which effectively subdivides the original circuit into fanout-free segments. This fanout-free characteristic allows a simplified analysis of multiple fault conditions. It is proven that the detection of a small subset of multiple faults guarantees the detection of all multiple faults. For any given circuit, the faults in this subset may be identified with a minimum of computation. Author (TAB)

**N69-37813#** Massachusetts Inst. of Tech., Cambridge.
**THE GRAPHIC DISPLAY AS AN AID IN THE MONITORING OF A TIME-SHARED COMPUTER SYSTEM**
Jerrold Marvin Grochow (M.S. Thesis) Oct. 1968 82 p refs
(Contract NONR-4102(01))
(AD-689468; MAC-TR-54) Avail: CFSTI CSCL 9/2

The graphical display monitoring system was developed as a medium for dynamic observation of the state of a time-shared computer system. The system is integrated to create graphic displays, dynamically retrieve data from the Multics time-sharing system supervisor data bases, and allow on-line viewing of this data via the graphic displays. On-line and simulated experiments were performed with various members of the Project MAC Multics staff to determine the most relevant data for dynamic monitoring, the most meaningful display formats, and the most desirable sampling rates. The particular relevance of using a graphic display as an output medium for the monitoring system is noted. As a guide to other designers, a generalized description of the principles involved in the design of this on-line, dynamic monitoring device includes special mention of those areas of particular hardware or software system dependence. Several as yet unsolved problems relating to time-sharing system monitoring, including those of security and data base protection, are discussed. Author (TAB)

**N69-37815#** Massachusetts Inst. of Tech., Cambridge.
**IMPLEMENTING MULTI-PROCESS PRIMITIVES IN A MULTIPLEXED COMPUTER SYSTEM**
Robert Lee Repaport (M.S. Thesis) Nov. 1968 135 p refs
(Contract NONR-4102(01))
(AD-689469; MAC-TR-55) Avail: CFSTI CSCL 9/2

In any computer system, primitive functions are needed to control the actions of processes in the system. The thesis discusses a set of six such process-control primitives which are sufficient to solve many of the problems involved in parallel processing, as well as in the efficient multiplexing of system resources among the many processes in a system. In particular, the thesis documents the work performed in implementing these primitives in a particular computer system - the Multics system - which is being developed at M.I.T.s Project MAC. During the course of work that went into the implementation of these primitives, design problems were encountered which caused the overall program design to go through two iterations before program performances was deemed acceptable. The thesis discusses the way the design of these programs evolved during the course of this work. Author (TAB)

**N69-37868#** Texas Univ., Austin. Electronics Research Center.
**DISTINGUISHABILITY CRITERIA IN ORIENTED GRAPHS AND ITS APPLICATION TO COMPUTER DIAGNOSIS, PART 2**
W. Mayeda and C. V. Ramamoorthy 21 Feb. 1969 23 p refs
(Grant AF-AFOSR-0766-67)
(AD-690127; TM-8; AFOSR-69-0843TR) Avail: CFSTI CSCL 9/2

In a previous paper (AD-685 739) the authors considered the application of graph theory to the problems in computer diagnosis. In particular the distinguishability criteria in directed graphs is developed and bounds on the number of test points needed to locate faults in a sequential system are derived. In the present paper it is shown that a system can also be diagnosed by means of test gates which block or unblock the flow of output signals at selected points in the system. In particular the distinguishability criteria in directed graphs is developed using only test gates, and bounds on the number of test gates needed to locate faults in a sequential system are derived. Since implementing test gates is vastly easier and cheaper than inserting and monitoring test points, the schemes proposed and results developed appear to be of practical significance. Author (TAB)

N69-37869# Michigan Univ., Ann Arbor.
**A COMPILER FOR ASSOCIATIVE OBJECT MACHINE**
William L. Ash May 1969 61 p refs
(Contract DA-49-083-OSA-3050; ARPA Order-716)
(AD-689881; TR-17) Avail: CFSTI CSCL 9/2

The paper discusses the design and construction of a compiler whose source language consists of sentences of a restricted predicate calculus, and whose output object code operates on a simulated associative target machine. The source programs are characterizations of relations, used for deriving one relation from others, and for completing relations. A program realizes the completion of a relation when it defines that relation in terms of itself, i.e., when the definition is recursive. Author (TAB)

N69-37881# Atomic Energy Commission Research Establishment, Riso (Denmark). Electronics Dept.
**RECORDED CURVE TO PUNCHED TAPE TABLE CONVERSION WITH EAI 600 AND PDP 8**
K. Soe Hojberg Apr. 1969 11 p
(RISO-M-879) Avail: CFSTI

An arbitrary function, y = f(x) given as a continuous recorded curve can be sampled at 2048 points or less and read out as a punched tape. An optical curve follower is used for automatic curve tracing. Author (ESRO)

N69-37930# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
**A COMPUTER PROGRAM TO EFFECT COMPUTER NETWORK TWO-WAY DATA TRANSMISSION ON A SINGLE SATELLITE CHANNEL, VOLUME 5 Final Report, Period Ending 30 Apr. 1969**
Stephen Klare and Robert Heller May 1969 120 p refs
(Contract N00014-67-A-0214-0003)
(AD-689125) Avail: CFSTI CSCL 17/2

A seven level encoder was breadboarded. A computer program was created to simulate the modem being breadboarded. The report gives a program (computer) that successfully simulates a 9600 bit/sec data rate being carried, encoded, on a 2400 cps channel. CDC 7000 series computers have sufficient speed to make the use of this program economically feasible indefinitely. IBM-360-50 have a crossover of about 421 computer core dumps before the modem use becomes more feasible. Author (TAB)

N69-38085# National Lending Library for Science and Technology, Boston Spa (England).
**ON THE PRINCIPLES OF THE CONSTRUCTION OF DIGITAL FILTERS FOR PROCESSING DATA IN THE STUDY OF RANDOM FIELDS**
Ju. M. Bykov et al 20 Jul. 1969 14 p refs Transl. into ENGLISH from Tr. Inst. Prik. Geof., Glav. Uprav. Gidromet. Sluzh. (Moscow), no. 10, 1967 p 87-100 In ENGLISH and partly in RUSSIAN
(NLL-M-7717-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Errors in the digital realization of data processing filters for random fields were studied by considering the impossibility of complete coincidence of frequency responses of the initial continuous filter and the filter realized in discrete form. It is shown that the relationships between the mean square error in the transmission of a random signal by linear filter realized in discrete form and the conditions of transmission of this signal by the required continuous operator determined the magnitude of error as a function of parameters fundamental in the planning of filters. Continuous operators with rapidly decreasing frequency responses and a large number of weighting coefficients were superior to filters with great oscillations; when the weighting coefficient number was fixed, the minimum bandwidth was ensured only by filters with minimum values of this parameter. G.G.

N69-38091# George Washington Univ., Washington, D.C. Logistics Research Project.
**DATA INPUT ERROR DETECTION AND CORRECTION PROCEDURES**
Thomas C. Varley (Ph.D. Thesis) (ONR) 2 Jun. 1969 246 p refs /its Serial T-222
(Contract N00014-67-A-0214)
(AD-689365) Avail: CFSTI CSCL 5/2

The study is an examination of the input data error problem in computerized information systems. The area of concern is the detection and correction of input data errors resulting from human recording during the initial collection of the data. This research attempts to remove some of the mystery surrounding the input error problem. A system for classifying errors by type is developed; attention is paid to the kinds of errors which can be made or introduced at various levels in the data generation-data processing chain. More important, these levels and their potential use to managers and researchers alike provide a conceptual framework in which intelligent discussions concerning the error process can be formulated. The concept of data worth alone provides a significant step forward in building an intelligent detection and correction process. The study develops a systematic procedure--a model--for evaluating the various detection and correction alternatives. The final evaluation of the detection and correction procedures to be used in the system is based on cost. This is not displacement cost, but cost associated with improved operations through more accurate information. The value of information is the worth of the data, and the worth of the data is the data accuracy problem. The major contributor to data accuracy is formal procedures for input error detection and correction. This study has developed these formal procedures. TAB

N69-38117# Lockheed Missiles and Space Co., Palo Alto, Calif.
**UNIT TO REDUCE REDUNDANT MEASUREMENT INFORMATION IN MEASURING INFORMATION SYSTEMS**
A. V. Fremke [1969] 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 12, no. 6, 1969 p 11-14
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A unit is described for reducing the redundancy of measurement information based on automatic regulation of the interrogation frequency of the transducers as a function of the first derivative of the input signals. Some analytic dependences are also presented for the coefficient of reduction of the quantity of signal measurements. Author

N69-38181*# Northrop Corp., Huntsville, Ala.
**SAMPLE REDUCTION TECHNIQUES FOR MINIMIZING QUANTIZATION ERRORS**
Ming-Yang Su 10 Aug. 1969 30 p refs
(Contract NAS8-30518)
(NASA-CR-61302; PR-794-9-504F) CSCL 09B

Quantization errors resulting from the analog-to-digital conversion of random time histories have been studied. An existing analysis of the quantization error of the time history itself was reviewed and further extended to treat the quantization error associated with the first derivative of the time history. An analytical theory on reducing the quantization error by means of a sample reduction method is also presented. A practical criterion for the amount of reduction in the quantization error by this method is also discussed. Author

N69-38214# Illinois Univ., Urbana. Coordinated Science Lab.
**ON THE DELAY REQUIRED TO REALIZE BOOLEAN FUNCTIONS**
Franco P. Preparata and David E. Muller Jul. 1969 14 p refs
(Contract DAAB07-67-C-0199; Grants NSF-GK-2339; NSF-GP-7421)
(AD-690098; R-421) Avail: CFSTI CSCL 9/2

Using as logic modules two-input one-output arbitrary logic gates, this paper considers the problem of the longest chain (number of levels) in a tree-type interconnection realizing a boolean function of n variables. Specifically, one is interested in the minimum number of levels L(N) by which one can constructively realize all boolean functions of n variables. It was previously shown that L(n) = or < n for n = 3,4 and it was so conjectured for n = 5; in this paper one is able to show that this holds for n = 5, 6, 7 and conjecture that L(8) = or < 8. Author (TAB)

**N69-38229#** Royal Aircraft Establishment, Farnborough (England). Structures Dept.

**METHODS OF SOLVING THE FLUTTER EQUATIONS IN USE AT RAE**

U. T. Niblett Aeron. Res. Council 1969 22 p refs Supersedes RAE-TR-68025; ARC-30502)

(ARC-CP-1046; RAE-TR-68025; ARC-30502) Copyright. Avail: CFSTI; HMSO: 5s 6d

Details are given of some of the methods of solving the flutter equations which have been programmed in Mercury Autocode at the R.A.E. Included is a method of following the variation of critical speed with a linear variation of the structural inertia, damping or stiffness. Author (ESRO)

**N69-38238#** Aeronautical Research Council (Gt. Brit.)

**AN EMA PROGRAM FOR THE ANALYSIS OF PLANE STRESS PROBLEMS**

Jane Buller-Sinfield 1969 33 p refs Supersedes RAE-TR-67275; ARC-30433

(ARC-CP-1037; RAE-TR-67275; ARC-30433) Copyright. Avail: CFSTI; HMSO: 8s

A computer program in Extended Mercury Autocode (EMA) is described for the finite element analysis of plane stress problems in regions of arbitrary geometry, using constant strain triangular elements. Author (ESRO)

**N69-38279#** Sandia Corp., Albuquerque, N. Mex. Analytical Development Div.

**ON THE RELAXATION OF TIME INCREMENT REQUIREMENTS IN STRUCTURAL COMPUTER PROGRAMS**

R. D. Krieg May 1969 50 p refs

(SC-DR-69-102) Avail: CFSTI

Stable time step increments in finite difference structural computer programs, such as DEPROSS and UNIVALVE, have been shown to depend upon the propagation velocities of longitudinal and flexural waves. Since these structural response programs are based upon the elementary Bernoulli-Euler beam theory, bending waves become large as the mesh spacing is reduced, resulting in short time step increments and correspondingly long computer run times for numerical stability. In this note, the relaxation of time increment requirements is attempted by addition of rotary inertia in an approximate sense. Dispersion characteristics of flexural waves in this approximate scheme are investigated and compared to well-known theories for a cylindrical bar. Results of this study indicate that computer time savings with this approximate scheme are somewhat limited, and that the approximate equations of motion are not well behaved in a certain region. It is not recommended that this scheme be utilized in structural computer programs. Author (NSA)

**N69-38361#** Illinois Univ., Urbana. Dept. of Computer Science.

**COMPUTER SYSTEMS RESEARCH Quarterly Technical Progress Report, Oct. - Dec. 1968**

1968 225 p refs

(COO-1018-1170; COO-1469-107) Avail: CFSTI

Topics include circuit research; hardware systems research; computer research; Illinois pattern recognition computer; ILLIAC 3; ILLIAC 4; numerical methods, computer arithmetic, and artificial languages; switching theory and logical design; SOUPAC section; IBM system/360 service; IBM 7094/1401 service, use, and development; and general department information. Author (NSA)

**N69-38377#** Sandia Corp., Albuquerque, N.Mex.

**SMALL COMPUTER MASTER-SLAVE OPERATION VIA VOICE GRADE TELEPHONE LINES**

John Maroon, Jr., John R. Rosborough, and Louis O. Cropp May 1969 41 p refs

(SC-RR-69-67) Avail: CFSTI

How the DEC PDP8 family of computers, data sets, and an inexpensive interface have been combined with a moderate amount of software to provide the small computer user with an extremely reliable and flexible means to control remotely located computers with computers of the same family is described. Using this system, any desired master-slave operation can be achieved. This system can be easily adapted to families of computers other than the PDP8. Author (NSA)

**N69-38433#** Maryland Univ., College Park. Computer Science Center.

**ON LIMIT PROPERTIES IN DIGITIZATION SCHEMES**

G. Ugo Montanari Jun. 1969 41 p refs

(Contract Nonr-5144(00))

(AD-690198; TR-69-95) Avail: CFSTI CSCL 09/2

Continuity of curve digitizations is considered, and it is pointed out that no proposed digitization scheme satisfies continuity requirements. A general definition of digitization scheme is given, having those in the literature as special cases, and it is proved that for practical purposes, no digitization scheme is possible, in which limit curves always have unambiguous digitizations. A weaker definition of continuity is then given, and this property is proved to hold for a large class of digitization schemes. These concepts apply when a curve with some extremal property must be reconstructed from the digitization. The cases of a least perimeter polygon and of a least energy rod are considered in detail. In the first case, necessary and sufficient conditions are developed that assure a one-to-one correspondence between the given digitization and the minimal polygon. The conversion of an algorithm for finding the minimal polygon, is proved in the convex case. Author (TAB)

**N69-38606#** Royal Aircraft Establishment, Farnborough (England). Structures Dept.

**A CONTROL AND MEASUREMENT SYSTEM FOR AEROELASTIC MODEL TESTS**

W. D. T. Hicks London HMSO 1969 28 p refs Supersedes RAE-TR-68238; ARC-31034

(ARC-CP-1045; RAE-TR-68238; ARC-31034) Copyright. Avail: CFSTI; HMSO 7s

A semi-automatic data handling system has been constructed at the R.A.E. for use in wind tunnel and laboratory tests on aeroelastic models. The system can accept fifty inputs of static information and fifty oscillatory inputs; the latter can be analysed to yield the components of each input that are in-phase and in-quadrature with a sinusoidal reference signal. The system can be programmed to handle, automatically, sequences of input data and, after analysis, to output the data in printed form and on punched paper tape. Graphical presentation of analysed oscillatory data is provided. The equipment has been used in several wind tunnel test programmes resulting in an economical use of wind tunnel test time and skilled manpower. Author (ESRO)

**N69-38672#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

**SPECIAL EQUIPMENT FOR PROCESSING CAN-RUPTURE MEASUREMENTS [EQUIPMENT SPECIALISE DE TRAITEMENT DES MESURES DE RUPTURE DE GAINES]**

Josef Kaiser, Jacques Philippou, Daniel Dumont, and Renaud Viellard Jun. 1969 68 p refs In FRENCH; ENGLISH summary

(CEA-R-3825) Avail: CFSTI

Recent installations for detecting can-rupture in nuclear reactors use partially or completely for measurement processing a digital computer. The reliability of the system is limited by that of the computer, which represents a common point for the processing

of data from a detector. In order to satisfy the demands imposed by safety considerations it is necessary to consider the possibility of installing a second computer in certain cases. Scalers operating as integrators for the pulses produced by the detector form the interface between the detection equipment and the computer. By adding a certain number of circuits to these scalers, it is possible to carry out the work now demanded of the computer, as far as the calculation is concerned. This reasoning has led to a so-called 'decentralized' solution involving the construction of specialized equipment in the region of the prospector itself. It is shown that this solution, apart from reliability considerations, has definite economic advantages. The common point in the processing of the data is situated not in the zone of the production of results but in the printing out of the results. Even in the case of an incident at the common point, the results are produced, exposed and compared to the alarm thresholds. In the case of a breakdown of the specialized equipment, the results from this prospector are no longer available but the others continue to operate. It seems that this solution is more reliable than that employing universal computers. By using an interchangeable drawer system (Multibloc) it is possible to replace rapidly any of the specialized equipment which breaks down. The systematic use of integrated circuits (TTL) ensures an increased reliability of the equipment. Author (ESRO)

# 09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

**N69-37233#** Pisa Univ. (Italy). Faculty of Engineering.
**DEVICE FOR AUTOMATIC CONTROL OF PRESSURE IN HIGH VACUUM SYSTEMS [DISPOSITIVO DI CONTROLLO AUTOMATICO DELLA PRESSIONE IN APPARECCHIATURE AD ALTO VUOTO]**
S. Annoni, G. Salardi, F. Uccelli, and L. Varrazzani. 1967. 9 p In ITALIAN *Its* Ser. 25, No. 1205
(Publ-17) Avail: CFSTI

The principles in the functioning of a proposed device for the automatic control of high vacuum apparatus are presented. Block diagrams, schematics of the logic, delay, and trigger circuits for an electron gun to be used in electro-optical experiments in this area are included. Transl. by F.O.S.

**N69-37248#** Pisa Univ. (Italy).
**AMPLIFIERS SENSITIVE TO PHASE INVERSION FOR THE CONTROL OF MOTOR ARMATURES WITH CONTINUOUS CURRENT OF LOW POTENTIAL [AMPLIFICATORE SENSIBILE ALLA INVERSIONE DELLA FASE PER IL CONTROLLO DI ARMATURA DI MOTORI A CORRENTE CONTINUA DI PICCOLA POTENZA]**
G. Guirand. 1967. 27 p refs In ITALIAN *Its* Ser. 25, No. 1201
(Publ-15) Avail: CFSTI

Systems for controlling dynamo amplification and motors with continuous current by amplifiers sensitive to the phase are considered. The possibility of modifying the traditional electronic amplifier of low potential, sensitive to phase inversion and signal input is examined for direct control of the armature current, eliminating the dynamo amplifier. A specific solution is presented and the results analyzed by an analog calculation for positioning an automatic synchronizer, functioning as a vector compensator for the transformation of polar Cartesian coordinates. Transl. by F.O.S.

**N69-37280#** Pisa Univ. (Italy). Instituto di Elettronica.
**STUDY OF A PARTICULAR SYSTEM FOR STABILIZING THE FREQUENCY OF A FREE ALTERNATOR [STUDIO DI UN PARTICOLARE SISTEMA DI STABILIZZAZIONE DELLA FREQUENZA DI UN ALTERNATORE LIBERO]**
F. Capparelli, R. Dalmazzo, and G. Marola. 1967. 34 p refs In ITALIAN *Its* 25th Ser., No. 7204
(Publ-16) Avail: CFSTI

The stabilization of the frequency of a free alternator is developed for a system in which the frequency variation is small compared to the frequency of the regime. In this hypothesis, the charge equilibrium constitutes the impedance. The transfer function which binds the variation of the angular velocity of the alternator to the charge variations is determined and used. The static and dynamic functioning are examined in charge equilibrium condition, and a procedure for calculating the values of the system for regulating the disturbances introduced by the charge variation is given. Transl. by F.O.S.

**N69-37289#** Naval Civil Engineering Lab., Port Hueneme, Calif.
**SUPERCONDUCTING LINEO DIODES: SOME PRELIMINARY OBSERVATIONS**
R. D. Hitchcock. May 1969. 19 p refs
(AD-688104; NCEL-TR-626) Avail: CFSTI CSCL 9/1

Superconducting line diodes were constructed by pressing a cylindrical film of oxidized tin against a plane film of oxidized tin. The 1-V characteristics at 1.5 degrees K were typical of superconducting point-contact and bridge junctions, and contained step structure indicative of Josephson self-resonances up to at least 1,200 GHz. Also, possible evidence of high-order quantum transitions was observed in the form of constant-voltage steps at voltages up to 47.6 mv. Two-junction experiments to determine the detector or emitter capability of the superconducting line diodes, yielded negative results. Author (TAB)

**N69-37296*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**ASSESSMENT OF RELIABILITY OF METAL-OXIDE-SILICON DEVICES**
Leon Hamiter and Ben Bagley. [1969] 26 p refs
(NASA-TM-X-61837) Avail: CFSTI CSCL 09E

This paper assesses metal-oxide-silicon (MOS) monolithic microcircuit usability and reliability as they affect possible use for certain space applications. Predominant failure modes and mechanisms are identified, failure rates are quantitatively assessed, and quality standards and test programs to reduce failures are recommended. User and manufacturer data presented substantiate a reasonable reliability and indicate MOS device suitability for high reliability use when properly controlled. Author

**N69-37305#** California Univ., Berkeley. Space Sciences Lab.
**AN IMPROVED RADIOMETER DETECTOR SYSTEM**
Douglas D. Thornton. May 1969. 17 p *Its* Space Sci. Lab. Ser. 10, Issue 20
(Contract Nonr-222(54))
(AD-689238) Avail: CFSTI CSCL 9/5

A detector circuit is described which has been used in many radiometer applications including highly sensitive receivers in the 18 to 40 Ghz region, multichannel receivers, and receivers for the 50 to 60 Ghz receivers where the noise temperature was 20,000 - 30,000K. The applications to detection of various constituents of the earths atmosphere, to detection of constituents in other planetary atmospheres, and to measurement of planetary temperatures all entailed detection and measurement of small changes in the antenna temperature. In all these cases the detector was found to work very well and overloading problems in the operation of the receivers were eliminated. Author (TAB)

**N69-37441#** Uppsala Univ. (Sweden). Dept. of Electronics.
**PUNCH THROUGH EFFECTS IN EVAPORATED METAL SEMICONDUCTOR CONTACTS**
L.-P. Andersson, S. Berg, N. Boonthanom, and O. M. Garcia Pacheco. Jun. 1969. 17 p refs

(UUIP-648) Avail: CFSTI

This paper shows that it is essential to have a non-injecting back contact in surface barrier detectors if the detector is to be fully depleted in order to obtain the best possible resolution. Investigations were made with detectors having a front contact of gold and a back contact of either aluminum or gold. It was found that freshly evaporated aluminum contacts were non-injecting, whereas gold contacts were injecting. ESRO

**N69-37475#** Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.

**HYBRID THICK AND THIN FILM MICROCIRCUITS: A REPORT BIBLIOGRAPHY**

John T. Milek 11 Mar. 1969 7 p refs

(Contract F33615-68-C-1225)

(AD-689758; EPIC-IR-66) Avail: CFSTI CSCL 9/5

The report bibliography covers the time span from 1966 to the present and is arranged in alphabetic sequence. A total of 63 references were found in the literature and were selected on the basis of having the subject descriptor hybrid in the title. Author (TAB)

**N69-37476#** Hughes Aircraft Co., Culver City, Calif. Electric Properties Information Center.

**RELIABILITY OF HYBRID MICROELECTRONIC CIRCUITS: A REPORT BIBLIOGRAPHY Interim Report**

John T. Milek 11 Mar. 1969 10 p refs

(Contract F33615-68-C-1225)

(AD-689757; EPIC-IR-65) Avail: CFSTI CSCL 9/5

This report bibliography has been prepared in response to a request for information on reliability of thin and thick film microelectronic circuits. A search of the literature was made and a total of 90 references were found. Author (TAB)

**N69-37477#** Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.

**FAILURE MECHANISMS/MODES IN MICROELECTRONICS Interim Report**

John T. Milek 6 Mar. 1969 25 p refs

(Contract F33615-68-C-1225)

(AD-689756; EPIC-IR-64) Avail: CFSTI CSCL 9/3

The report presents a review of the modes of failure in various types of microcircuits. A bibliography is included. TAB

**N69-37478#** Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.

**THIN-FILM DIELECTRICS FOR MICROELECTRONICS: A BIBLIOGRAPHY COMPILATION Interim Report**

John T. Milek 3 Jul. 1968 33 p refs

(Contract F33615-68-C-1225)

(AD-689755; EPIC-IR-63) Avail: CFSTI CSCL 9/1

The report was in response to a request for information on various thin-film dielectric materials used for making capacitive elements in microelectronics circuitry. Included are sections on the following: Thin film capacitors (general); Silicon monoxide film capacitors; Silicon dioxide film capacitors; Silicon nitride film capacitors; Tantalum oxide and other tantalate film capacitors; Titanium oxide film capacitors; Aluminum oxide film capacitors; Hafnium oxide film capacitors; Barium titanate and other titanate film capacitors; Solium niobate and other niobate film capacitors; Miscellaneous materials film capacitors. TAB

**N69-37482#** Pisa Univ. (Italy). Istiuto di Elettronica.

**ON THE VELOCITY CONTROL THREE PHASE SYNCHRONOUS MOTORS WITH FIELD EQUILIBRIUM ACTIVATED BY MEANS OF SATURABLE REACTORS [SUL CONTROLLO DI VELOCITTA A CAMPI EQUILIBRATI DEI MOTORI ASINCRONI TRIFASI, ATTUATO MEDIANTE REATTORI SATURABILI]**

F. Capparelli and C. Pachetti 1968 33 p In ITALIAN *Its* Ser. 25, No. 1215

(Publ-18) Avail: CFSTI

The theory is presented, and the fundamental results deduced which satisfy the characteristic parameters for obtaining the velocity regulation with three phase field equilibrium in a synchronous motor. The conditions which permit the control of the field equilibrium are given, and the system is described. Transl. by F.O.S.

**N69-37634#** RAND Corp., Santa Monica, Calif.

**THE SCATTERING OF WAVES BY A CYLINDRICAL PIEZOELECTRIC INCLUSION**

F. C. Moon Jun. 1969 38 p refs

(AD-689243; P-4102) Avail: CFSTI CSCL 9/1

The general problem of the scattering of waves from a transversely isotropic piezoelectric cylinder is examined. The solution for the interaction of an electromagnetic wave with a circular piezoelectric cylinder or antenna is presented. Solutions for the scattering of axial shear and compressional elastic waves by a piezoelectric circular cylinder embedded in an elastic medium are also presented. A few numerical results are presented for barium titanate. Author (TAB)

**N69-37718#** Naval Avionics Facilities, Indianapolis, Ind.

**THE EVALUATION OF THE GRIPLET TERMINAL**

William M. Shank May 1969 21 p

(AD-689787; NAFI-TR-1349) Avail: CFSTI CSCL 9/1

The document covers evaluation tests on a special design of terminals for printed wiring boards. TAB

**N69-37780*#** Bendix Corp., Holmdel, N.J. Semiconductor Div.

**SAFE OPERATING AREA DETERMINATION FOR PREVENTION OF SECOND BREAKDOWN**

[1969] 185 p

(Contract NAS8-21155)

(NASA-CR-102250) Avail: CFSTI CSCL 09A

The true dynamic characteristics of selected power transistors used in critical space applications were determined. Using the safe operating area (SOAR) principle, transistor parameters in all operating and breakdown situations were tested. The purpose of these evaluations is to assist in the application, selection, performance, and the reliability of semiconductor devices in critical NASA systems. Ten n-p-n silicon power transistors were evaluated for SOAR in six critical functions; actual power handling capability for each type was determined. From the manufacturer's specifications, test curves, and SOAR evaluation, recommendations were made to design personnel and for the use of manufacturer's in better device selection. M.H.E.

**N69-37788#** RAND Corp., Santa Monica, Calif.

**EMISSION RATES IN THERMIONIC DIODES**

Cecilia Y. Fleck Jun. 1969 86 p refs

(Contract F44620-67-C-0045; Proj. RAND)

(AD-689762; RM-5810-PR) Avail: CFSTI CSCL 10/2

The report discusses the derivation of a new expression for the free area function for translation of adsorbed particles in the study of the surface physics of thermionic diode electrodes. A relatively new theory involves direct energy conversion through utilization of thermionic emission of electrons from a hot metal. This Memorandum studies the surface effects that control emission rates in a totally different way. Using a digital computer, the surface migrations of particles adsorbed on a surface are simulated. The simulation incorporates relevant geometrical and energetic considerations as realistically as possible, and calculates the free area for translation by a Monte Carlo process. When the resulting expression for free area is used in calculations, a substantial improvement can be seen in the agreement between predicted and measured emission rates. Author (TAB)

**N69-37794#** Rome Air Development Center, Griffiss AFB, N.Y.

**FAILURE MECHANISM IN PLASTIC ENCAPSULATED MICROCIRCUITS**

Alfred L. Tamburrino and Vincent C. Kapfer May 1969 34 p refs
(AD-689224; RADC-TR-69-111) Avail: CFSTI CSCL 9/5

This paper deals with the question of military acceptance of microcircuits encapsulated in plastic materials. A discussion of military applications and requirements and their relation to device qualification testing and screening is given. It is pointed out that qualification tests are based neither upon absolute minimum standards nor validly derived acceleration factors, but on experience with similar devices, and knowledge of the expected capabilities of good devices. Epoxy, phenolic, and silicone encapsulated microcircuits have been subjected to a variety of high stress tests and four basic types of failures observed: external surface conduction, internal (silicon chip) surface effects, aluminum metallization corrosion, and bond breakage due to thermal mismatch. Author (TAB)

**N69-37841#** Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
**ON 3200 ANGSTROM PHOSPHOR Quarterly Report, 1 Jan. – 31 Mar. 1969**
Jon W. Ogland, Edward C. Marlarkey, and Michael R. Natale Fort Monmouth, N.J. ECOM Jun. 1969 32 p refs
(Contract DAAB07-68-C-0392)
(AD-689473; QR-3; ECOM-0392-3) Avail: CFSTI CSCL 9/1

The objective of the contract is to conduct a research and development program leading to the production of a cathodoluminescent phosphor which emits with high efficiency in the spectral region around 3200 A. The phosphor is to be incorporated into very high resolution cathode-ray tubes with fiber optic faceplates for data recording on UV sensitive, dry-process film. Primary emphasis during this period was given to the development of $Zn_2SiO_4$:$TiO_2$ for the purpose of producing a phosphor to replace P-16 in tubes designed to emit at 3800 A. The best sample prepared gave an efficiency twice that of P-16 at high excitation densities, showed a maintenance two to three orders of magnitude better than P-16, and had a radiative decay time of 3.8 microsec. Efficiency and maintenance measurements were made on the best samples of beta-$CaSiO_3$:Pb and $BaSi_2O_5$:Pb. A considerable effort was expended in attempts to prepare luminescent thallium-doped $BaSi_2O_5$ without success; a change in furnace design is expected to alter this situation in the next period. A preliminary sample of $BaZnSi_4O_{10}$:Pb has been prepared and found to emit at 3250 A. Author (TAB)

**N69-37844*#** Martin Marietta Corp., Denver, Colo.
**SPACECRAFT MICROMINIATURE PAM DECOMMUTATOR SYSTEM Final Report**
Jul. 1969 26 p
(Contract NAS9-8301)
(NASA-CR-101902; MCR-69-369) Avail: CFSTI CSCL 09E

Operation and testing of the system are summarized. The PAM input signal is positive going and returning to zero. Its peak-to-peak amplitude is between 2.5 and 5.0 volts, and no excursions go below 0 volts dc or +5 volts dc. The normal input signal will have been filtered with a low-pass linear phase filter that is 3 db down at 2.3 $f_0$ (data channel rate) and has an ultimate roll-off of 18 db per octave. The return-to-zero portion of the input waveform may vary from 0 volts to +2.5 volts, but the absolute excursion limits of 0 and +5 volts will be maintained. The duty cycle of the PAM input signal may vary between 30% and 70%. The data rate may be any one of four. The decommutator was tested for thermal stability, altitude performance, generation of hazardous gases, electromagnetic interference, and electrical performance. Author

**N69-37886#** North Carolina State Univ., Raleigh. Center for Acoustical Studies.
**ON THE ELECTROMECHANICAL COUPLING AND ELECTRICAL IMPEDANCE OF A THIN PIEZOELECTRIC DISK WITH AN ARBITRARY IMPEDANCE ON THE BOUNDARY Technical Report, 1968 – 1969**
Ralph A. Nelson, Jr. and Larry H. Royster May 1969 13 p refs
(Contract NONR-486(11))
(AD-689206; TR-4; CAS-39) Avail: CFSTI CSCL 9/1

Expressions are developed for the electrical impedance, resonant frequencies, and dynamic electromechanical coupling coefficient for an arbitrary impedance on the boundary of a thin piezoelectric disk. The equations are then specialized for the case of a spring-like boundary condition. Author (TAB)

**N69-37867#** Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
**RADIATION PROPERTIES OF THERMISTOR BEADS**
William Michael Tuscano 10 Feb. 1969 80 p refs
(Contract F19628-68-C-0210)
(AD-689805; SR-1; AFCRL-68-0448) Avail: CFSTI CSCL 9/1

Meteorological measurements of temperatures in the atmosphere are made with thermistor beads which are attached to the tips of rocketsondes. Errors in these measurements are a consequence of heat transfer processes between the bead and its environment; a significant heat transfer process is thermal radiation from the sun to the bead. Thermistor beads are coated with vacuum deposited aluminum in order to minimize the effects of thermal radiation; in order to evaluate these effects, the radiative properties of the beads must be determined. The electromagnetic theory is applied to a specular isotropic aluminum surface to determine the monochromatic hemispherical, normal and directional emittances in the wavelength interval .486 microns to 2.0 microns. Due to the geometrical shape of the bead, an approximate average monochromatic absorptance is defined and calculated in the wavelength interval .546 mirons to 2.0 microns. Five randomly selected thermistor beads are tested for individual monochromatic absorptance in the wavelength range of .55 microns to 2.0 microns. Author (TAB)

**N69-37892#** Uppsala Univ. (Sweden). Inst. of Physics.
**SCHOTTKY-BARRIER IN VERY HIGH RESISTANCE OHMIC SILICON CONTACTS [SCHOTTKY-BARRIAERER PA MYCKET HOEGOHMIGT KISEL, SPECIELLT 'OHMSKA' KONTAKTER]**
L. P. Andersson and S. Berg Dec. 1968 19 p refs In SWEDISH
(UUIP-619)

N-type silicon material is investigated as to its usability for contact material, using various doping densities. An Al-Si-Al metalsemiconductor junction is prepared and the barrier effect is discussed, taking into account the current limitation and the emission current. Current voltage characteristics are measured, which show an ohmic behavior of the contact for certain material parameters. ESRO

**N69-37929#** North Carolina State Univ., Raleigh. Center for Acoustical Studies.
**AN EQUIVALENT SOURCE STRENGTH MATH MODEL FOR THE CLASS 1 FLEXTENSIONAL UNDERWATER ACOUSTIC TRANSDUCER SHELL DESIGN Technical Report, 1968 – 1969**
Jack N. Boone and Larry H. Royster Apr. 1969 27 p refs
(Contract Nonr-486(11))
(AD-689205; CAS-37; TR-2) Avail: CFSTI CSCL 9/1

A mathematical model is presented that defines the normalized equivalent source strength for the Class I and approximates the Class II Flextensional Underwater Acoustic Transducer Shells. The predicted variations in the normalized equivalent source strengths for various curved beam opening angles and L/d ratios are presented. Author (TAB)

**N69-37937#** Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
**TUNNEL DIODE AMPLIFIERS AND THEIR BACKGROUND NOISE AS A FUNCTION OF THE POLARIZATION POINT.**

**THE TEMPERATURE, AND THE BANDWIDTH [AMPLIFICATEURS A DIODE TUNNEL ET LEUR BRUIT DE FOND, EN FONCTION DU POINT DE POLARISATION, DE LA TEMPERATURE ET DE LA BANDE PASSANTE]**

Kazem Ozveaminian (Ph.D. Thesis--Grenoble Univ., 19 Jan. 1968) Jun. 1969 143 p refs In FRENCH; ENGLISH summary (CEA-R-3709) Avail: CFSTI

Mathematical and graphical methods for the study of the stability of tunnel diode circuits are discussed and an application to the realization of three amplifiers is given. A theoretical and experimental investigation of the noise of these amplifiers and of its variations with bias, temperature and bandwidth is also described. Author (ESRO)

**N69-37971#** Microwave Associates, Inc., Burlington, Mass.

**STUDY OF CYCLOTRON AND SYNCHRONOUS WAVE DEVICES Triannual Report No. 2, 1 Nov. 1968 – 1 Feb. 1969**

S. F. Paik, N. W. Harris, and R. J. Briggs Ft. Monmouth, N.J. ECOM Feb. 1969 47 p refs

(Contract DAAB07-68-C-0398)

(AD-689472; ECOM-0398-2) Avail: CFSTI CSCL 9/1

An experimental study of the circuit used in earlier experiments showed that oscillations observed were due to the interaction of the electron beam with undesirable modes and space-harmonics which were neglected in the previous study. Two types of helix-derived circuits, a tightly wound helix with a longitudinally conducting shield and a bifilar helix, were considered as possible substitutes for the twisted slow-wave structure. The bifilar helix appears attractive as an experimental tool to investigate various interaction mechanisms and the velocity spread. The effect of finite size of the beam on the longitudinal velocity spread was considered. The result of theoretical study shows that the ultimate efficiency and/or the power output may be limited by this effect. Author (TAB)

**N69-38026#** Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.

**DEVELOPMENT OF TRANSMITTER TUBE FOR TROPOSCATTER APPLICATIONS, 1 NOVEMBER 1968 – 28 FEBRUARY 1969**

A. L. Rousseau Fort Monmouth, N.J. ECOM May 1969 24 p refs

(Contract DAAB07-68-C-0477)

(AD-689492; W-2860-2; ECOM-0477-2) Avail: CFSTI CSCL 17/2.1

The program objectives are to determine the design criteria for a highly efficient (50% overall efficiency including focusing and cooling power), 10 kW CW traveling-wave amplifier at C-band and to construct, test and deliver two (2) advanced exploratory development models of the device. This amplifier is to have 11 dB of gain to boost the output power of existing 1 kW troposcatter systems using readily available power generators. Techniques to improve the efficiency by reducing the power necessary to cool the device are an integral part of the program. The tube employs a coupled cavity interaction circuit with a solenoid focused, semi-confined flow electron beam. Improvement in basic tube efficiency is accomplished by voltage jump and phase velocity tapering combined with collector depression. Cooling efficiency is improved by utilizing vapor phase (nucleate boiling) cooling, which eliminates the need for a coolant pump. During the report period cold test work and fabrication of the first advanced exploratory model tube were completed with the exception of attaching the waveguides. Author (TAB)

**N69-38027#** Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.

**DEVELOPMENT OF TRANSMITTER TUBE FOR TROPOSCATTER APPLICATIONS, 1 JULY – 31 OCTOBER 1968**

A. L. Rousseau and O. G. Sauseng Fort Monmouth, N.J. ECOM May 1969 76 p refs

(Contract DAAB07-68-C-0477)

(AD-689491; W-2860-1; ECOM-0477-1) Avail: CFSTI CSCL 17/2.1

The program objective is to determine the design criteria for a high efficient (50% overall efficiency including focusing and cooling power) 10 kW CW traveling-wave amplifier at C-band and to construct, test and deliver two (2) advanced exploratory development models of device. This amplifier is to have 11 dB of gain to boost the output of existing 1 kW troposcatter systems using power generators readily available. Techniques to improve the efficiency by reducing the power necessary to cool the device are an integral part of the program. The tube employs a coupled cavity interaction circuit with a solenoid focused, semi-confined flow electron beam. Improvement in basic tube efficiency is accomplished by voltage jump and phase velocity tapering combined with collector depression. Cooling efficiency is improved by utilizing vapor phase (nucleate boiling) cooling, which eliminates the need for a coolant pump. Author (TAB)

**N69-38034#** Argonne National Lab., Ill. Reactor Physics Div.

**WIDE-BAND CHARGE-SENSITIVE PREAMPLIFIER FOR PROTON-RECOIL PROPORTIONAL COUNTING**

J. M. Larson Feb. 1969 18 p refs

(Contract W-31-109-ENG-38)

(ANL-7517) Avail: CFSTI

This report describes a solid-state charge-sensitive preamplifier for use with proportional counters in proton-recoil spectrometers. The preamplifier has a charge gain of $2 \times 10^{12}$ V/coulomb and exhibits a rise time of 15 nsec, without overshoot, with 10 pF of external input capacity. A high-transconductance field-effect transistor is used in the input stage and near theoretical noise performance is obtained. The circuit is direct-coupled and is compatible with pole-zero compensated amplifier systems. The preamplifier features a 20-V peak output swing to allow high count-rate capability and the amplification of extreme overloads without saturation. Author (NSA)

**N69-38077#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

**DEVELOPMENT OF A COINCIDENCE CIRCUIT WITH NANOSECOND RESOLVING TIME FOR NaI(Tl) SCINTILLATOR PULSES [REALISATION D'UN CIRCUIT DE COINCIDENCE POSSEDANT UNE RESOLUTION VOISINE DE LA NANOSECONDE POUR DES IMPULSIONS DELIVREES PAR SCINTILLATEUR NaI(Tl)]**

Roger Ripon and Gérard Coussot Jun. 1969 13 p refs In FRENCH; ENGLISH summary

(CEA-R-3814) Avail: CFSTI

The principle and the details of a slow-fast type coincidence circuit for pulses delivered by NaI(Tl) scintillators are presented. Thanks to a voluntary limitation of the analysis band (150 keV to 1 MeV) an excellent stability is obtained with respect to thermal drifts. The resolving time which has been adopted, 4 ns with 100 per cent efficiency, is quite sufficient for the projected experiment but does not represent the optimum performance of which the circuit is capable. Author (ESRO)

**N69-38129#** Fondazione Ugo Bordoni, Rome (Italy).

**PERFORMANCES OF PCM TELEPHONE CODECS OPERATING BOTH IN MIDRISER AND MIDSTEP CONDITIONS [CONFRONTO TRA LE PRESTAZIONI DEI SISTEMI TELEFONICI PCM UTILIZZANTI CO-DECODIFICATORI CON E SENZA SILENZIAMENTO]**

Maurizio Decina and Luigi Giacomelli *In* Ist. Super. Poste e Telecomun. Rept., News and Book Rev., Vol. 17, No. 4 Aug. 1968 p 654-684 refs In ITALIAN; ENGLISH summary (See N69-38126 22-34)

Avail: CFSTI

The calculation of signal-to-noise ratios, loss, interchannel cross talk and idle channel noise was carried out for PCM codecs operating both in midriser and midstep conditions. The PCM codecs under examination employ the logarithmic companding law A = 87.6 achieved by 13 segments and 7 or 8 digits for coding the voice signal. Furthermore, an analysis is made of the compatibility between midstep coders (decoders) using 8 digits and midriser decoders (coders) using 7 digits. Author (ESRO)

**N69-38163#** Varian Associates, Palo Alto, Calif.
**A DEVELOPMENT PROGRAM TO IMPROVE THE BROADBANDING OF HIGH POWER AMPLIFIER KLYSTRONS Quarterly Progress Report, 1 Oct. – 31 Dec. 1968**
Walter Dickey Jan. 1969 31 p refs
(Contract DAAB07-68-C-0060)
(AD-689484; Rept-357-5Q; QPR-5) Avail: CFSTI CSCL 9/1

Both VA-962s, the high power tubes, were built and evaluated. The feasibility tube, VA-962 No. 1, evidenced some degradation of performance from that expected. The performance of VA-962 No. 2, however, indicates that all requirements for the 16 kW (high power) tube can be met. The life test tube (VA-961 No. 2) is still being operated with no apparent degradation of performance. Author (TAB)

**N69-38167#** Bunker-Ramo Corp., Canoga Park, Calif. Defense Systems Div.
**CONSOLE CONTROL UNIT Final Technical Report, 1 Feb. – 15 Aug. 1968**
Frank Hughes and Richard J. Braun Griffiss AFB, N.Y. RADC May 1969
(Contract F30602-68-C-0221)
(AD-689222; G0147-8U22; RADC-TR-68-405) Avail: CFSTI CSCL 9/5

This final technical report describes the Console Control Unit (CCU) developed for the Strategic Air Command Program Assisted Console Evaluation and Review (SAC/PACER) system. The CCU was developed for the purpose of interfacing from one to eight SAC/PACER display consoles--BR-90E with the external user system of the GE-635 data processing system. Connection is made at one of the super high-speed terminals of the input/output controller (IOC), Model C. The CCU meets specifications defining the standard interface used between any common peripheral subsystem and the external user system of the GE-635. The CCU functions as data translator between the 6-bit (plus parity) character of the GE-635 and the 12-bit word of the BR-90E, responds to all signals from the external user system, and generates meaningful signals for interpretation by the GE-635. The SAC/PACER system is now fully implemented and operationally successful. Author (TAB)

**N69-38191#** Brookhaven National Lab., Upton, N.Y. Accelerator Dept.
**SIMPLE MODEL OF THE SMITH SUPERCONDUCTING CABLE**
G. H. Morgan 5 May 1969 14 p refs Sponsored by AEC
(BNL-13716) Avail: CFSTI

The Smith superconducting cable consists of a single strand of a normal metal in which is embedded a large number of paraxial superconducting filaments or cores, the strand being twisted with a certain pitch (p). Smith came to the conclusion that if such a conductor is exposed to an external changing field, Be, the currents induced for $p/2 < l_c$ ( a certain critical length) are largely confined to the filaments, and the power losses are thus mainly the usual hysteretic loss in the filaments. Smith's expression for $l_c$ is $l^2_c \approx \lambda J_c d\rho/B_e$, where $J_c$ is the critical current density in the superconductor, d is the filament diameter, $\rho$ the normal metal resistivity, $B_e$ is the rate of change of field, and $\lambda$ is a constant approximate unity. These results are confirmed here, but it is found that the equation may have a different form depending on the core configuration. Expressions for the power loss in the normal metal and the time constant are obtained. NSA

**N69-38198#** Pisa Univ. (Italy). Istituto Di Elettrotecnica.
**ON THE STABILITY INDEX IN THREE PHASE ISOTROPIC AND ANISOTROPIC PROPERTY OF GRID DAMPENING [SULL' INDICE DI STABILITA NEI SINCRONI TRIFASI ISOTROPI ED ANISOTROPI PROVVISTI DI GABBIA SORZATRICE]**
G. Mariotti, and M. Lemmi-Gigli 1967 36 p refs In ITALIAN Its Ser. 25, No. 1217
(Publ-110) Avail: CFSTI

A definition of the stability index is developed for quantitative mixing in a three-phase-synchronous motor connected in parallel to a network of constant voltage and frequency, with the capability to absorb small amplitude disturbances superimposed on the general functioning of the regime. The case in which there are satisfactory conditions in the actual and practical design for verification is treated using the indications centered on the parameter of stability; these deductions are then applied to more general cases. It is concluded that the stability index can be approximated in a simple expression for application to the practical design of high and normal voltage motors. Transl. by F.O.S.

**N69-38264#** Stanford Univ., Calif. Dept. of Electrical Engineering.
**ACTIVE INTEGRATED CIRCUIT SYNTHESIS**
Robert W. Newcomb Jan. 1969 304 p refs
(Contract F44620-67-C-0001)
(AD-688781; AFOSR-69-1442TR) Avail: CFSTI CSCL 9/5

Active integrated circuit synthesis presents the latest practical results of research conducted in university and industrial laboratories as well as the new theories now emerging. The coherent and comprehensive treatment starts with basic discussions of prime elements of integrated components and generating elements of basic gain blocks. The book progresses through state-variable theory, active and passive rc synthesis (including feedback circuits), element replacement, method comparison, and advanced topics as distributed networks and quasilossless time-variable synthesis. Author (TAB)

**N69-38300#** Raytheon Co., Quincy, Mass. Industrial Components Operation.
**RESEARCH AND DEVELOPMENT OF HIGH-BRIGHTNESS PROJECTION KINESCOPES Final Report, May 1964 – Apr. 1967**
Gordon R. Spencer May 1969 63 p
(Contract AF 33(615)-1753)
(AD-689749; ICR-101; AFHRL-TR-68-6) Avail: CFSTI CSCL 9/1

In a preliminary phase of study and experimentation, a number of luminescent materials were investigated to provide a basis of selection of a phosphor for subsequent application in a high-brightness projection cathode-ray tube. Utilizating the principle of forced-cooling of the phosphor substrate to limit the thermal contribution to brightness saturation, a projection tube was developed having an angled neck, an ion-trap tetrode gun, and a clear glass optical window situated parallel to a liquid-cooled metal baseplate on which the phosphor screen was deposited. Three models of this tube were constructed. Measurements showed the tube capable of providing an acceptable quality projection television display of 9 ft. Lamberts brightness in a 3 ft. x 4 ft. image, using an f/1.2 lens and viewing screen having a gain of 2. Tube life was found to be in excess of 500 hours of operation with continuous, intense, full-raster bombardment, resulting in less than 50% reduction in luminous efficiency. Author (TAB)

**N69-38302#** Naval Postgraduate School, Monterey, Calif.
**DESIGN OF ACTIVE FILTER SYSTEMS USING PARAMETER PLANE TECHNIQUES**
Ronald Clement Funk Dec. 1968 75 p refs
(AD-689727) Avail: CFSTI CSCL 9/5

Since parameter planes were introduced, considerable investigation has been conducted in proving that the results obtained by this method are in agreement with those obtained from

various other proven techniques. Research undertaken in this paper illustrates methods by which parameter planes are useful in the design of electrical networks. The investigations were conducted on an active parallel-T filter, in which the utilization of the constant bandwidth curves are beneficial, and the high Q double tuned filter, where constant zeta curves aided in the design. Author (TAB)

**N69-38358#** Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.
**LOCK-IN AMPLIFIER FOR NMR SIGNAL DETECTION**
F. Toth and K. Tompa 15 Apr. 1969 11 p refs
(KFKI-11/1969) Avail: AEC Depository Libraries

A lock-in amplifier with 100 kohm and 100 ohm input impedances, built for the detection of signals in the presence of high background noise, is described. The minimum detectable signal is of order 1 nV for $10^{-20}$ W, generating 100 ohm input impedance with an observation time of less than 1 min. The operating frequency can be varied per stage. The phase angle of the signal relative to the reference can be changed from a linear angular scale to better then ± 2% accuracy. Author (NSA)

**N69-38368#** Union Carbide Corp., Oak Ridge, Tenn.
**STANDARD LEAK TEMPERATURE CONTROLLER**
F. W. Henson 4 May 1969 46 p refs
(Contract W-7405-ENG-26)
(Y-1668) Avail: CFSTI

Standard leaks with leak-rate values of $1 \times 10^{-8}$ cubic centimeters of volume per second or less require permeation leakrate elements. To achieve the desired stability of standard leaks in this range requiring permeation elements, a standard leak temperature controller was developed. The electronic circuit which was designed, constructed, and tested for use in controlling the standard leak temperature included a differential amplifier with a thermistor bridge input, a single-phase silicon-controlled rectifier with a unijunction transistor trigger to phase control the 110-volt, 60-Hertz power applied to a resistance heater, a power supply, and an independent temperature measuring bridge. Of the several processed in particulate-free clean rooms. A feasibility study of the trigger angle, the shunt control transistor method was selected due to its high gain at minimum output. Author (NSA)

**N69-38477#** Colorado Univ., Boulder. Dept. of Electrical Engineering.
**SYNTHESIS OF HIGH SPEED HOMOPOLAR ALTERNATORS AND THEORY OF SOLID ROTOR ELECTRICAL MACHINES, PHASE DD, PART 4 Final Report**
Edward A. Erdelyi and M. S. Serme Mar. 1969 84 p refs
(Contract DA-44-009-AMC-797(T))
(AD-688673) Avail: CFSTI CSCL 9/3

The calculation of the performance characteristic of high-speed, aerospace, solid rotor induction motors is attempted. The mathematical model is three-dimensional, so that changes in the torque-speed characteristic caused by the losses in the end region of the solid rotor are considered. The iterative relaxation method described calculates the electromagnetic quantities in the solid rotor as function of three space variables and the time. The appropriate partial differential equations, their transformation to partial difference equations, and the boundary condition are developed. The iteration procedure is explained, flow diagrams and computer programs are included. The whole scheme is then applied to calculate the torque in a 5 h.p., six-pole, 3200 cps, 145 volts, wye-connected induction motor. Author (TAB)

**N69-38532#** International Business Machines Corp., Owego, N.Y. Federal Systems Div.
**RELIABILITY INVESTIGATION OF MULTILAYER INTERCONNECTION BOARDS (MIB'S) Final Technical Report, Sep. 1967 – Oct. 1968**
H. C. Hurley, L. F. Briggs, M. E. Pelling, T. M. Strong, and M. A. Young Feb. 1969 370 p refs
(Contract F30602-68-C-0019)
(AD-689845; IBM-68-354-021; RADC-TR-68-598) Avail: CFSTI CSCL 9/5

The results of a test program to investigate failure mechanisms of multilayer interconnection boards (MIB's) are reported. The overall objective was a more fundamental understanding of the reliability characteristics of MIB's, as related to design, manufacturing and environmental variables. The test approach used was an experimental type of accelerated testing, called 'enhanced-defects' testing. Implementation was successfully carried out using two special MIB test vehicles designed to exhibit controlled-enhancement of failure occurrence during environmental tests. Test samples were prepared by marginal off-setting of selected design and processing variables. Test results for MIB open failure modes revealed a PTH-fracture failure mechanism which occurs as a result of temperature change, and is relatable to MIB material properties, PTH geometry and processing variables. MIB short failure modes were shown to be largely dependent on temperature and relative humidity but also relatable to MIB design variables, e.g., line spacing and processing variables. Failure models for MIB failure mechanisms are postulated. Author (TAB)

**N69-38587*#** National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
**LEAK DETECTION IN HERMETICALLY SEALED DEVICES**
I. Litant Washington Oct. 1969 13 p refs
(NASA-TN-D-5457) Avail: CFSTI CSCL 09A

A method for detecting leaks in a hermetically sealed device was developed. The method comprises the introduction of a low-boiling halogenated liquid into the device through the leaks, and detecting the vaporizing liquid as it escapes from the leaks by the use of a halogen detector. The leaks may thus be pinpointed, and the leak rate determined. Author

# 10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

**N69-37398#** Uppsala Univ. (Sweden). Inst. of Physics.
**EVALUATION OF CAPACITANCE MEASUREMENTS ON HIGH RESISTIVITY SILICON SURFACE BARRIER DIODES**
S. Berg, L. P. Andersson, O. M. Garcia Pacheco (Concepcion Univ.), and N. Boonthanom (Chiengmai Univ.) Feb. 1969 33 p refs
(UUIP-630) Avail: CFSTI

The relationship between capacitance and voltage was measured on surface-barrier diodes manufactured from high resistivity N-type silicon. Forward and backward currents were studied in order to compare the measured current with the current predicted by Schottky. The simple models for the width of the depletion region are presented but none of these alone can explain the measured results. An expression is derived which is found to be in very good agreement with experimental results. The origin of the barrier-height between gold and silicon is discussed as well as differences in the work function between metal and silicon, the influence of surface states and introduction of traps or recombination centers introduced by the evaporated metal. ESRO

**N68-37413#** Pisa Univ. (Italy). Istituto di Elettrotecnica.
**THE CHARACTERISTIC ELEMENTS OF THE STABILITY OF SYNCHRONOUS ISOTROPIC ROTARY FLOW UNMECHANICALLY RELEASED IN THE PRESENCE OF SMALL AMPLITUDE DISTURBANCES [GLI ELEMENTI CARATTERISTICI DELLA STABILITA DEL SINCRONO ISOTROPO A FLUSSO ROTORICO MECCANICAMENTE**

**SUINCOLATO IN PRESENZA DI DISTURBI DI PICCOLA AMPIEZZA]**
G. Mariotti and M. Lammi-Gigli 1967 28 p refs In ITALIAN *Its* Ser. 24, No. 1194
(Publ-106) Avail: CFSTI

The synchronous isotropic three phase torque developed by orthogonal two spin electrical excitation is investigated in a system of differential equations, which defines in a perturbation regime of small amplitude, the variations of emf and deviation coupling as functions of the current variation, and the coupling angle. The relation between the coupling angle and variations in the deviation coupling is deduced for the synchronous isotropic flow mechanically released when the voltage and force are constant. Stability considerations are developed by using the coefficients for synchronism and damping, which are functions of the timing.
Transl. by F.O.S.

N69-37483# Pisa Univ. (Italy). Istituto di Elettrotecnica.
**ON THE STATIC BEHAVIOR OF SYNCHRONOUS, ISOTROPIC SPIN FLOW, MECHANICALLY RELEASED [SUL COMPOPTAMENTO STATICO DEL SINCRONO ISOTROPO A FLUSSO ROTORICO MECCANICAMENTE SVINCOLATO]**
G. Mariotti and M. Lammi-Gigli 1967 35 p refs In ITALIAN *Its* Ser. 25, No. 1193
(Publ-105) Avail: CFSTI

A synchronous-isotropic-three phase flow provided by two perpendicular spin rotors respectivly excited by continuous current with constant spin, and constant current automatically maintained by the sign of the angle of the traverse spin is studied. The experimental theory is limited to the static behavior, which is evidenced by the simultaneous actions of the two excitations derived from a particular situation for the induced complex flow. As a function of the charge of the machine, this results in the release for changing the angle of rotation. The experimental results confirm the theoretical studies.
Transl. by F.O.S.

N69-37611# Fondazione Ugo Bordoni, Roma. (Italy).
**METHODS FOR DETERMINATION OF THE SCANNING FREQUENCY IN DIRECT DIGITAL CONTROL SYSTEMS [I METODI PER LA DETERMINAZIONE DELLA FREQUENZA DI CAMPIONAMENTO NEI SISTEMI A CONTROLLO DIGITALE DIRETTO]**
Michele Le Cave *In* Ist. Super. Poste e Telecomun. Rept., News and Book Rev., Vol. 18, No. 1 Feb. 1969 p 72-81 In ITALIAN; ENGLISH summary (See N69-37508 22-07)
Avail: CFSTI

Methods for selecting the sampling interval in direct digital control systems are described and compared. Methods for the synthesis of servosystems are discussed and particular attention is given to the amplitude of the application field and to the computing procedures of each of them. Methods for the synthesis of regulators are discussed and some graphs for the selection of a first trial value of the sampling interval are given.
Author (ESRO)

N69-37612# Istituto Superiore delle Poste e delle Telecomunicazioni, Roma (Italy).
**SOME FUNDAMENTAL ASPECTS OF AMPLIFIER NETWORKS CONTAINING NEGATIVE RESISTANCES [ALCUNI ASPETTI FONDAMENTALI DELLE RETI AMPLIFICATRICI CONTENENTI RESISTENZE NEGATIVE]**
Aldo Rovert (Fondazione U. Bordoni) *In its* Rept., News and Book Rev., Vol. 18, No. 1 Feb. 1969 p 92-133 In ITALIAN; ENGLISH summary (See N69-37508 22-07)
Avail: CFSTI

This paper deals with three important subjects regarding the theory of negative-resistance amplifiers i.e. the asymptotic stability of the linearized structure, the sensitivity of network functions to variations of the negative resistance values and the characterization of noise.
Author (ESRO)

N69-37619 National Lending Library for Science and Technology, Boston Spa (England).
**THE TRANSMISSION OF PULSES THROUGH A NETWORK CONTAINING A LINE INCORPORATING A RECTANGULAR HYSTERESIS LOOP FERRITE [O PEREDACHE IMPULSOV CHEREZ TRAKT, SODERZHASHCHII LINIYU S FERRITOM PPG]**
I. G. Katsev et al Jun. 1968 11 p refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved., Radioelektron. (USSR), v. 11, no. 6, 1968 p 570-576
(NLL-RTS-5125) Avail: Natl. Lending Library, Boston Spa, Engl., 17s 6d

The circuit considered consists of a linear transmission line followed by a line containing a rectangular hysteresis loop ferrite, then another linear line. It is shown that when the characteristic impedances of the lines $\rho_1$ and $\rho_3$ and the nonlinear line $\rho_0$ are all equal, ignoring the magnetization of the ferrite and certain other conditions, the wave is transmitted at full amplitude from the generator to the load but with a sharpened wavefront. The range of values of $\rho_{1/\rho_0}$ over which power compression takes place is evaluated. Methods are suggested for measuring the value of the nonlinear line.
Author

N69-37626# Naval Avionics Facility, Indianapolis, Ind.
**EXPLORATORY ENVIRONMENTAL EVALUATION OF SOLDERLESS WRAPPED CONNECTIONS Final Report**
Orville E. Davis 31 Jan. 1969 93 p
(AD-689117; NAFI-TR-1242) Avail: CFSTI CSCL 9/3

The solderless wrapped connection (or wire wrap connection) is finding extensive use in both commercial and military electrical and electronic equipments. Wire wrapping is a technique for electrically and mechanically connecting a solid conductor to a terminal by wrapping a specified number of turns of wire, under tension, around a terminal having two or more sharp edges. The increasing use of the solderless wrapped connection as a wiring technique is accompained by an increasing need for a comprehensive evaluation of the wrapped connection to determine its performance capabilities under a wide spectrum of environmental states, including those encountered under both ground and aerospace conditions. As a step in fulfilling this need an exploratory environmental evaluation program was conducted to establish environmental capabilities of wire wrap connections with respect to temperature, vibration and salt spray exposures, and to provide designers and users with some guidelines for wire wrap application in military systems. Although basic test procedures and environmental limits were developed around existing military specifications, the severity of these tests, both in duration and environmental extremes, was extended well beyond the requirements of these specifications. This was done in an effort to explore wire wrap characteristics under conditions far more extreme than those presently specified for wrapped connections and to possibly establish ultimate capabilities. TAS

N69-37726# Pisa Univ. (Italy). Istituto di Elettrotecnica.
**ANALYSIS OF THE COUPLING COEFFICIENTS OF THE SYNCHRONOUS ISOTROPIC IN A ROTATING FLUX MECHANICALLY RELEASED [ANALISI DEI COEFFICIENTI DI COPPIA DEL SINCRONO ISOTROPO A FLUSSO ROTORICO MECCARICAMENTE SVINCOLATO]**
G. Mariotti and M. Lammi-Gigli 1967 37 p refs In ITALIAN *Its* Ser. 24, No. 1196
(Publ-108) Avail: CFSTI

The synchronous isotropic stability of the three phase flux inductor is studied, when bound to a field with constant voltage and frequency. The perturbation is considered in terms of the coupling coefficient, synchronized and dampened by the frequency response of a system subjected to small amplitude disturbances. These effects are separated into excitation, and a direct constant of the automatic transverse dynamics, which characterize a system of inductance. Other factors which influence the circuit parameters

of synchronism, and those which limit the effects of the excitation, are discussed. Transl. by F.O.S.

N69-38014# Pisa Univ. (Italy). Istituto di Elettrotecnica.
**ELECTRIC CHARACTERISTICS OF THE FUNCTIONING OF ALTERNATE CURRENT LINES WITH SINGLE PROBE CAVITIES IN THE INSULATION MINERAL [CARATTERISTICHE ELETTRICHE DI FUNZIONAMENTO DELLE LINEE IN CORRENTE ALTERNATA CON CAVI UNIPOLARI AD ISOLAMENTO MINERALE]**
Franco Nencioni 1967 24 p refs In ITALIAN *Its* Ser. 2S, No. 1209
(Publ-109) Avail: CFSTI

Electrical equilibrium equations for power line systems with single pole cavities in the insulating mineral sheath are determined. Both the single phase and the three phase systems are considered. The expressions of equivalent impedance for the direct and inverse phase for constant current density in sheathed conducters are developed. The significant physical properties in high power, and power loss conditions are discussed. The dependence of the impedance of the various parameters, particularly frequency and the properties of the cavities, on temperature, and the distance between the cavities is analyzed. The experimental results are considered in good agreement with theoretical computations. Transl. by F.O.S.

N69-38127# Fondazione Ugo Bordoni, Rome (Italy).
**ACTIVE SYNTHESIS OF NETWORK FUNCTIONS WITH SEVERAL VARIABLE PARAMETERS [SINTESI ATTIVA DI FUNZIONI DI RETE CON PARAMETRI VARIABILI]**
Valerio Cimagalli (Rome Univ.) *In* Ist. Super. Poste e Telecomun. Rept., News and Book Rev., Vol. 17, No. 4 Aug. 1968 p 613-623 refs In ITALIAN; ENGLISH summary (See N69-38128 22-34)
Avail: CFSTI

After a short discussion of the use of functions of several variables in designing variable parameter networks, a new method of synthesis is described, which gives a class of network functions of several variables. One variable is the usual complex frequency, while each other variable is realized as the gain of only one controlled source, even if the function to be realized contains products of these variables. Two examples illustrate the case of functions bilinear with respect to every variable other than the complex frequency 's'. Author (ESRO)

N69-38128# Fondazione Ugo Bordoni, Rome (Italy).
**DESIGN AND PRACTICAL REALIZATION OF A VARIABLE EQUALIZER BY MEANS OF A MULTIVARIABLE FUNCTION ACTIVE SYNTHESIS METHOD [PROGETTO E COSTRUZIONE DI UN EQUALIZZATORE VARIABILE MEDIANTE UN METODO DI SINTESI ATTIVA DI FUNZIONI DI PIU VARIABILI]**
M. Salerno *In* Ist. Super. Poste e Telecomun. Rept., News and Book Rev., Vol. 17, No. 4 Aug. 1968 p 624-653 refs In ITALIAN; ENGLISH summary (See N69-38126 22-34)
Avail: CFSTI

A new method for the active synthesis of multivariable functions is presented. It has been used for designing and realizing a variable telephone amplitude equalizer. By varying three set parameters a set of amplitude-curves is obtained covering all the possible cases of interest in connection with the CCITT recommendations. These parameters affect respectively the frequency ranges 300-1000 Hz, 1000-2600 Hz, and 2000-3400 Hz. Measurements carried out on the realized device show good agreement with the theory. Author (ESRO)

N69-38143*# Analytic Sciences Corp., Reading, Mass.
**DESIGN OF STRAPDOWN GYROSCOPES FOR A DYNAMIC ENVIRONMENT Semiannual Report, 1 Dec. 1968 - 31 May 1969**
William S. Beetow and Arthur A. Sutherland, Jr. Jul 1969 18 p refs
(Contract NAS12-509)
(NASA-CR-86245; TR-101-5) Avail: CFSTI CSCL 09C

A review of work done on strapdown gyros which employ the time modulation torquing technique is presented. Comparison is made between the sinusoidal frequency response predicted by describing function analysis and that obtained from simulation. Current investigations related to compensating strapdown sensors by measuring the environment and computing corrective action are also presented. The initial steps to analyze the dynamics of gyros with gas spin bearings are covered, and the direction of future efforts are outlined. Author

# 11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N69-37304# Federal Aviation Administration, Washington, D.C. Airports Service & Air Traffic Service.
**A SUGGESTED ACTION PROGRAM FOR THE RELIEF OF AIRFIELD CONGESTION AT SELECTED AIRPORTS**
L. N. Million, J. M. Copeland, J. T. Hamabe, and W. C. Koepcke Apr. 1969 213 p refs
(AD-689107) Avail: CFSTI CSCL 1/5

This report separately identifies and analyzes the possible improvements leading to reduced aircraft delays at eighteen of the Nations highest density airports. Discussion is presented on the causes contributing to aeronautical congestion and on the current operational status of each airport. The report is concerned primarily with physical construction projects which will enhance the particular airport's airfield capacity such as high-speed exit taxiways, parallel runways, and navigational aids. It also examines certain procedural improvements such as intersection takeoffs and part-time use of taxiways as VFR runways. Each airport improvement, where possible, has been evaluated from a cost vs. delay benefit savings viewpoint. The result is a series of recommended actions for each surveyed airport with emphasis given to those items which can be constructed or implemented and placed in operation within one to four years. Author (TAB)

N69-37418# Houston Univ., Tex. Dept. of Physics.
**SHIELDING WITH SUPERCONDUCTORS IN SMALL MAGNETIC FIELDS**
Alvin F. Hildebrandt [1968] 15 p refs Presented at the CNRS Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1968
Avail: CFSTI

The shielding properties of a superconducting lead shell have been investigated in fields of the order of 10$^4$ gauss. The small ambient fields were obtained with a room size $\mu$-metal shield. Fields of less than 2 microgauss were obtained over a sphere of 7.5 cm diameter. This region is at room temperature and is suitable for magnetometer testing. Author (ESRO)

N69-37423# Engins Matra, Velizy (France).
**MEASUREMENT OF WEAK MAGNETIC FIELDS IN AN INDUSTRIAL ENVIRONMENT [MESURES DES CHAMPS MAGNETIQUES FAIBLES DANS UN ENVIRONNEMENT INDUSTRIEL]**
R. C. Affeticati and J. P. Granger [1968] 15 p In FRENCH Presented at the CNRS Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1968
Avail: CFSTI

A laboratory equipment is described which has been designed

to test satellite instruments for magnetic cleanness. The tested equipment is located at the enter point of Helmoltz coils for elimination of the magnetic field effect. Special care has been taken to eliminate as far as possible all perturbing magnetic fields caused by the industrial environment. ESRO

**N69-37525#** European Space Research and Technology Center, Noordwijk (Netherlands).
**GENERATING THE THERMAL ENVIRONMENT OF A SPACECRAFT IN THE LABORATORY**
E. H. Classen, J. H. Makkink, and J. B. Walker *In* ESRO Environments and their Role in Spacecraft Technol., Vol. 2: Feb. 1969 68 p refs (See N69-37526 22-33)
Avail: CFSTI

The thermal environment of a spacecraft in near-earth orbit is defined. Methods of simulating the thermally important conditions are described and the merits of different techniques stated. The basic elements of the typical thermal balance testing facility are set down, together with observations on what simulation is necessary and practical within the present state of the art. An assessment of the errors arising in spacecraft temperature due to the imperfections of laboratory simulation is made. Some probable future developments in the field of space simulation are mentioned. Author (ESRO)

**N69-37696#** European Space Research and Technology Center, Noordwijk (Netherlands).
**GENERATING THE THERMAL ENVIRONMENT OF A SPACECRAFT IN THE LABORATORY**
E. H. Classen, J. H. Makking, and J. B. Walker Paris ESRO Feb. 1969 74 p refs Presented at the 6th ESRO Summer School, Noordwijk, Neth., 1968
(ESRO-TN-72) Avail: CFSTI

The thermal environment of a spacecraft in near-earth orbit is defined. Methods of simulating the thermally important conditions are described and the merits of different techniques stated. The basic elements of the typical thermal balance testing facility are set down, together with observations on what simulation is necessary and practical within the present state of the art. An assessment of the errors arising in spacecraft temperature due to the imperfections of laboratory simulation is made. Some probable future developments in the field of space simulation are mentioned. Author (ESRO)

**N69-37697#** European Space Research and Technology Center, Noordwijk (Netherlands).
**INTENSITY MEASUREMENTS OF CARBON ARC LAMPS IN ESTEC TEST FACILITY HBF 2**
H. A. Schütz Paris ESRO Jan. 1969 28 p refs
(ESRO-TM-137-ESTEC) Avail: CFSTI

The purpose of the tests described in this paper is to investigate the intensity distribution and intensity level of the light from the carbon arc lamps (Genarco ME6 CWM) used in the ESTEC heat balance facility HBF 2. For each of the five lamps the intensity in the reference plane was measured by means of ten silicon solar cells mounted on a straight arm; the measurements were carried out for arc currents between 320 A and 420 A. The change in intensity due to degradation of the optics was investigated over an operation time of about 10 hours. From the results it was found that it was best to operate the lamps at 380 A and it is recommended that four lamps should be used in HBF 2 instead of three, as used at present. A short description is given of a test in which the solar cells are mounted on a shaped arm following the contour of the spacecraft and the results are briefly compared with those obtained with the straight-arm method. Author (ESRO)

**N69-37833#** European Space Research and Technology Center, Noordwijk (Netherlands).
**THE MEASUREMENT OF THERMAL SURFACE PROPERTIES**
M. J. Downey and G. Schamlé Paris ESRO Feb. 1969 36 p refs Presented at 6th ESRO Summer School, Noordwijk, Neth., 1968
(ESRO-TN-74) Avail: CFSTI

The equipment used for the measurement of thermal properties of surfaces at satellite temperatures is reviewed. The equipment in use at ESTEC, e.g. optical equipment for absorptance and for emittance measurements, thermal equipment for measurement of the ratio, and portable equipment for direct work on satellites, is described. Some information is given on the laboratory simulation of space environment. Author (ESRO)

**N69-37761#** Federal Aviation Administration, Washington, D.C. Environmental Development Div.
**ENVIRONMENTAL EFFECTS ON AIRPORT PAVEMENT GROOVE PATTERNS**
George A. Kilpatrick Jun. 1969 46 p
(FAA-RD-69-37) Avail: CFSTI

Results of installing different groove patterns on a variety of asphalt and concrete taxiways at airports with varying climatic regimes are presented. Methods and procedures effecting the installation of groove patterns in airport pavements are discussed, as well as the resulting changes in the groove patterns over the observation period of seven to eighteen months. Some deterioration of grooves occurred in the taxiways with asphalt surfaces under high temperature conditions. Recommendations based on these tests are presented for future grooving projects. Author

**N69-38061#** Richland Operations Office (AEC), Wash.
**CLEAN ROOM FIRE PROTECTION: TWO YEARS LATER**
D. J. Keigher *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 339-341 (See N69-38042 22-22)
Avail: CFSTI

Clean room fire hazards are mentioned and the need for introducing adequate safety measures is stressed. Broader dissemination of data on clean room fire losses is desirable. E.C.

**N69-38111#** Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
**CALIBRATION OF THE RAE BEDFORD 8 ft. × 8 ft. WIND TUNNEL AT SUBSONIC SPEEDS, INCLUDING A DISCUSSION OF THE CORRECTIONS APPLIED TO THE MEASURED PRESSURE DISTRIBUTION TO ALLOW FOR THE DIRECT AND BLOCKAGE EFFECTS DUE TO THE CALIBRATION PROBE SHAPE**
D. Isaacs Aeron. Res. Council 1969 81 p refs Supersedes RAE-TR-67038; ARC-29310
(ARC-R/M-3533; RAE-TR-67038; ARC-29310) Copyright. Avail: CFSTI; HMSO: £1 11s 6d

A calibration of the 8 ft × 8 ft. wind tunnel has been performed at subsonic speeds using a multiple orifice, traversing static pressure probe on the tunnen centreline. Full details have been obtained of the static pressure distribution along the tunnel centreline between 69 inches upstream and 50 inches downstream of the tunnel datum. Additional measurements were made of tunnel washwall static pressure distributions. Modifications to the nozzle profile, introduced just prior to the present calibration in order to reduce the size of the static pressure gradient, proved successful. Author (ESRO)

**N69-38224*#** Arizona Univ., Tucson. Engineering Experiment Station.
**ADDENDUM TO NASA SYNCHRODYNE CONTRACT Final Report**
[1969] 111 p refs
(Grant NGR-03-002-169)
(NASA-CR-105968) Avail: CFSTI CSCL 14B

The purpose of this design is to provide a research and fabrication facility for monolithic integrated circuits; the integrated

circuit laboratory will complement the existing hybrid circuit facility. To minimize the initial cost of the proposed facility, their existing building is utilized with a minimum number of modifications, and existing equipment is incorporated into the design. For the purpose of purchasing new equipment, a list of recommended equipment is included for all major areas. The design includes the equipment arrangement, building modifications, manpower requirements, and a schedule for laboratory development. Author

**N69-38406#** Sandia Corp., Albuquerque, N.Mex. Contamination Control and Process Acceptance Div.
**ACTIVATED CHARCOAL FILTRATION: A SUPPLEMENT TO HEPA FILTRATION IN CLEAN ROOMS AND WORK STATIONS**
James C. Mashburn and Robert T. Sylvester Jun. 1969 23 p refs Sponsored by AEC
(SC-DR-69-316) Avail: CFSTI

High-efficiency particulate air (HEPA) filters are used in laminar flow clean rooms and clean work stations. However, HEPA filters were not designed to remove gaseous vapors, such as the $SO_2$ and $NO_2$ constitutents of smog, which can corrode or deposit undesirable films on electromechanical components being processed in particulate-free clean rooms. A feasibility study of the particulate/ gaseous filtration capabilities of Type AC activated charcoal when used in series with HEPA filters is reported. An experimental-type clean bench was designed and constructed to demonstrate that an activated charcoal/HEPA filter combination could remove not only the airborne particulates but also adsorb gaseous vapors that might film or corrode the components being produced in clean rooms. Author (NSA)

# 12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

**N69-37206#** University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
**FEASIBILITY OF SLIP VELOCITY MEASUREMENT USING DOPPLER TECHNIQUE IN ARGON**
Timothy Norman Sloat and Paul B. Scott Dec. 1968 71 p refs
(Grant AF-AFOSR-697-67A)
(AD-689567; USCAE-111; AFOSR-69-1227TR) Avail: CFSTI CSCL 1/1

The feasibility of measuring slip velocities by observing the Doppler shift in electron beam excited radiation is investigated. The expected Doppler shift in the 4277 A line of argon gas is 0.00276 A. Line broadening effects are dominated by Doppler broadening, which at flow conditions near the leading edge, results in a half-intensity width of 0.00146 A. Using a Fabry-Perot interferometer, the line shift and Doppler profiles are readily resolved near the leading edge. A few suggestions are made for increasing the signal level, including crossing the electron beam with an argon ion laser beam. Author (TAB)

**N69-37208#** Dartmouth Coll., Hanover, N.H. Dept. of Physics.
**HYDRODYNAMIC OF SUPERFLUID HELIUM WITH QUANTIZED VORTICITY AND PHASE CORRELATION Final Technical Report**
John N. Kidder Jan. 1969 24 p refs
(Contract AF 49(638)-1717)
(AD-689293; AFOSR-69-1446TR) Avail: CFSTI CSCL 20/13

The studies accomplished on superfluid capillary flow are described. Also included are a list of publications generated and student theses prepared. Author (TAB)

**N69-37218#** Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
**DE-EXCITATION SHOCKS IN A VIBRATIONALLY RELAXING GAS**
P. A. Blythe, D. G. Petty (Coll. of Aeronaut.), D. A. Schofield (Natl. Phys. Lab., Teddington, Engl.), and J. L. Wilson (N. E. L., East Kilbride, Scot.) Feb. 1969 38 p refs
(Contract DAAD05-69-C-0083; Proj Themis)
(AD-689480; CAM-110-2) Avail: CFSTI CSCL 20/4

Some recent work on the existence of vibrational de-excitation shocks (delta-shocks) in expanding non-equilibrium nozzle flows is extended to include situations in which an adiabatic shock (alpha-shock) may be embedded within the de-excitation shock. A discussion of some further properties of the shock solution is given and some examples are worked out. Numerical solutions of the full equations are also presented. These solutions confirm the existence of the alpha-shocks but bring to light certain anomalies in the simple approximate solution. The modifications necessary to remove these discrepancies are outlined, and the implications of the numerical results are briefly discussed. Author (TAB)

**N69-37247#** Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
**EXTENSIONS OF EXTREMUM PRINCIPLES FOR SLOW VISCOUS FLOWS**
Richard Skalak Apr. 1969 59 p refs
(Contract N00014-67-A-0108-0003)
(AD-689156; TR-4) Avail: CFSTI CSCL 20/4

Several generalizations of theorems of the types originally stated by Helmholtz concerning the dissipation of energy in slow viscous flow have been given recently by Keller, Rubenfeld and Molyneux. These generalizations included cases in which the fluid contains one or more solid bodies and drops of another liquid assuming the drops do not change shape. Some further extensions are given which allow for drops which may be deformed by the flow and include the effect of surface tension. The admissible boundary conditions have also been extended and particular theorems applicable to infinite domains, spatially periodic flows and to flows in infinite cylindrical pipes are derived. Uniqueness theorems are also proved. Author (TAB)

**N69-37271*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EFFECT OF ANGLE OF ATTACK AND INJECTION PRESSURE ON JET PENETRATION AND SPREADING FROM A DELTA WING IN SUPERSONIC FLOW**
Frederick P. Povinelli, Louis A. Povinelli, and Martin Herach Washington Sep. 1969 23 p refs
(NASA-TM-X-1889) Avail: CFSTI CSCL 20D

Helium injection into the vortex flow generated over the lee side of a half-delta model was studied in a Mach 2 airstream. Concentration contours were obtained at two positions downstream of the injection orifice. Angle of attack and injection pressure were varied. Oil-streak photographic data were used to determine the location of the vortex on the delta surface. Penetration and spreading of the injectant were enhanced with increasing angle of attack. Increasing injection pressure increased the penetration but had little effect on spreading. Maximum penetration occurred at the highest angle of attack and injection pressure tested. Author

**N69-37289*#** McDonnell-Douglas Astronautics Co., Santa Monica, Calif.
**INCIPIENT SEPARATION OF A TURBULENT BOUNDARY LAYER AT HIGH REYNOLDS NUMBER IN TWO-DIMENSIONAL SUPERSONIC FLOW OVER A COMPRESSION CORNER**
G. J. Thomke and A. Roshko Moffett Field, Calif. NASA Ames Research Center 31 Jan. 1969 62 p refs
(Contract NAS7-589)

(NASA-CR-73308; DAC-59819) Avail: CFSTI CSCL 20D

An experimental study was made of the conditions necessary to promote incipient separation of a turbulent boundary layer in two-dimensional supersonic flow over a compression corner. Measurements were obtained for Mach numbers in the range 2 to 5 and at Reynolds numbers, based on the boundary-layer thickness, in the range $10^6$ to $10^7$, nearly two orders of magnitude greater than those reported earlier. The main result was that the trend with Reynolds number established by Kuehn for the pressure rise for incipient separation does not continue to the high Reynolds number values of the present experiments; in fact, it is reversed. Pressure distributions were also obtained for conditions with and without separation. For the latter case, the upstream influence was considerably less than one boundary-layer thickness and the initial part of the pressure rise was practically a jump, suggesting that the oblique shock has its origin deep in the boundary layer. Author

**N69-37351#** Royal Aircraft Establishment, Farnborough (England).
**THE CAUCHY PROBLEM FOR SMALL FLUCTUATIONS OF A VISCOUS FLUID IN A WEAK FIELD OF MASS FORCES [O ZADACHE KOSHI DLYA MALYKH KOLEBANII VYAZKOI ZHIDKOSTI V SLABOM POLE MASSOVYKH SIL]**
N. D. Kopachevskii Jan. 1969 33 p refs Transl. into ENGLISH from J. Computational Math. Math. Phys. (USSR), v. 7, no. 1, 1967 p 128–146
(RAE-LIB-TRANS-1325) Avail: CFSTI

The paper deals with the Cauchy problem for the unsteady linearized Navier–Stokes equations, representing small deviations of a viscous incompressible fluid from equilibrium in a partially filled motionless vessel in a weak field of force. Surface forces are taken into account, leading to the presence, in the boundary conditions on the surface of the fluid, of a second order differential operator of elliptic type. Existence and uniqueness theorems for the solution of the problem are presented and proved by the methods of functional analysis; an introductory section discusses the decomposition of the Hilbert space and derives or gives references to results required later in the paper. Author

**N69-37370*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**UPWASH PATTERNS ON ABLATING AND NONABLATING CONES OF HYPERSONIC SPEEDS**
John B. McDevitt and Jack A. Mellenthin Washington Jul. 1969 34 p refs
(NASA-TN-D-5346) Avail: CFSTI CSCL 20D

A study has been made of the upwash patterns on slender ablating and nonablating cones at angle of attack in the hypersonic flow regime. An oil-film technique was used to display the surface streamlines on the nonablating models and tests were conducted with both laminar and transitional boundary layers. The boundary-layer-edge Mach number and model wall temperature were found to have a strong influence on the magnitude of surface upwash angles. The measured surface upwash angles at small angles of attack agreed well with theoretical estimates in the laminar case. At transitional Reynolds numbers clear evidence was obtained that streamwise vortices are entrained within the boundary layer for cones at angle of attack. Tests of ablating cones at transitional Reynolds numbers resulted in upwash groove patterns eroded in the model surfaces. These grooves were interpreted to be the result of vortices intensifying local heating rates. The upward inclination of the grooves agreed closely with the inclination of the vortex paths measured on the nonablating cones under similar test conditions. Author

**N69-37371** British Hydromechanics Research Association, Cranfield (England).
**THE CASCADE DIODE**
B. E. A. Jacobs and P. J. Baker Feb. 1968 20 p refs
(RR-941) Copyright. Avail: Issuing Activity

Experiments were carried out on a cascade type of fluid diode in order to determine the ratio of the pressure drop in the reverse-flow direction to the pressure drop in the forward-flow direction at the same Reynolds number. This ratio, known as the performance, has been found to be strongly dependent on the length of the diode, over the range tested. A simple analysis of the flow was undertaken, and expressions for the reverse flow loss coefficient were obtained. Author

**N69-37520#** Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
**THE EXPANSION OF A SUPERSONIC PARALLEL FLOW INTO A SOURCE FLOW**
Gordon E. Merritt Sep. 1969 10 p refs
(CAL-172) Avail: CFSTI

Proposed is a method to eliminate a potential source of flow nonuniformity arising at the inlet of the second stage expansion. This is believed to be caused by high Mach numbers at the entrance of the second stage conical nozzle, and by the contour inlet walls. A method was developed to convert supersonic parallel flow into conical or source flow with allowances made for boundary layer growth in the nozzle walls. Good agreement was obtained from the calculations made. E.H.W.

**N69-37624#** Harry Diamond Labs., Washington, D.C.
**FLUERICS. PART 27: FLUERIC TEMPERATURE-SENSING OSCILLATOR DESIGN**
Wilmer Gaylord and Vondell Carter Apr. 1969 72 p refs
(AD-689444; HDL-TR-1428) Avail: CFSTI CSCL 13/7

Studies were conducted to determine the dependence of output-signal characteristics on cavity (resonator) dimensions of flueric temperature-sensing oscillators. The effects of resonator dimensions (length and width), of nozzle area ratio, and of edge distance from the inlet nozzle on the operational threshold, frequency, amplitude, and signal-isolation ratio were studied. The information derived can be utilized to make the process of flueric temperature sensor-oscillator design a more precise and scientific operation. Experimental data have been arranged to show the relationship of signal characteristics to resonator configuration (dimensions) and environment (pressure and temperature). Author (TAB)

**N69-37645** National Lending Library for Science and Technology, Boston Spa (England).
**THE HYDRAULIC ANALOGY**
L. W. Koot 28 Apr. 1969 40 p refs Transl. into ENGLISH from Ing. (The Hague), v. 80, no. 34, Aug. 1968 p 183–195 In ENGLISH and DUTCH
(NLL-EE-TRANS-1884-(3774.5)) Avail: Natl. Lending Library, Boston Spa, Engl.

Under certain conditions compressible and incompressible gas flows can be compared with the flow of water with a free surface over a horizontal flat plate. This is referred to as a "hydraulic analogy". The original way in which this analogy is derived is described in this article. The limitations governing the application of the hydraulic analogy are readily explained. This analogy is of special interest to all those concerned with practical flow-dynamics problems: it provides a quick understanding of such problems and a simple method for obtaining information. A water table is currently in use at the energy-supply laboratory of the Delft Technological University. A larger one providing the facilities required for extended tests is in the design stage: it will enable the analogy to be applied to practical problems. Author

**N69-37650#** Stanford Univ., Calif. Dept. of Civil Engineering.
**COMPUTER STUDIES OF FINITE-AMPLITUDE WATER WAVES**
Robert K.-C. Chen, Robert L. Street, and Theodor Strelkoff Jun. 1969 109 p refs
(Contract NONR-225(71); Grant NSF-GK-2506) (AD-689369; TR-104) Avail: CFSTI CSCL 20/4

Two numerical techniques are utilized to study the motion of two-dimensional, finite-amplitude water waves by using an electronic digital computer. The non-linear properties of water waves are of primary interest. The first part of the work introduces the Stanford-University-Modified MAC (SUMMAC) code which is proposed as a valid tool for analyzing incompressible, viscous flows with a free surface under transient conditions. The method is applied to the study of the solitary wave run-up on a vertical wall. The results are compared with the available experimental data and give a much better prediction of the wave run-up than the existing analytic theory. In the second part, Newtons process of successive corrections is applied to solve steady-state potential flows with free surface and gravity. A specific application to the analysis of solitary waves is made and all the wave characteristics are in excellent agreement with experiments. Author (TAB)

**N69-37579*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**THE USE OF SUBSONIC ORIFICES FOR MEASUREMENT OF GAS FLOW**

Thomas A. Cygnarowicz and Ronald Corazzi Sep. 1969 9 p refs Submitted for publication

(NASA-TM-X-63678; X-734-69-408) Avail: CFSTI CSCL 20D

An approximate equation is derived for calculation of gas weight flow rate through subsonic orifices for small differential pressures. Comparison to the exact equation shows good correlation even at conditions far removed from those assumed in the derivation. A limited test program verifies the applicability of the approximation. Author

**N69-37604*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**EFFECTS OF ANGLE OF ATTACK AND BLUNTNESS ON LAMINAR HEATING-RATE DISTRIBUTIONS OF A 15 DEG CONE AT A MACH NUMBER OF 10.6**

Joseph W. Cleary Washington Oct. 1969 56 p refs

(NASA-TN-D-5450) Avail: CFSTI CSCL 20D

Distributions of laminar heating rates are presented from wind-tunnel tests in air at a free-stream Mach number of 10.6 and unit Reynolds numbers from $0.4 \times 10^6$ to $1.8 \times 10^6$ per foot. Results shown are for angles of attack from 0° to 20° and bluntness ratios from 0 to 0.183. Measurements are included of surface streamlines made by an oil-streak technique. Heating-rate measurements are compared with predictions of similarity theory for $0 \leq \alpha \leq 20°$ and good agreement is indicated. Author

**N69-37605*#** Houston Univ., Tex. Dept. of Mechanical Engineering.

**ON THE STABILITY OF POISEUILLE PIPE FLOW**

Henry J. Crowder and Charles Dalton Aug. 1969 169 p refs

(Grant NGR-44-005-065)

(NASA-CR-105922; TR-1) Avail: CFSTI CSCL 20D

The problem of the stability of Poiseuille pipe flow was studied numerically. The finite-difference equations which were solved are approximations to the nonlinear, axisymmetric, Navier–Stokes equations in cylindrical coordinates subject to a stream-function perturbation. The disturbance to the stream function is of the form $A_m[R^2{}_1/2 - R^4{}_1/4] \sin(\Lambda_r t)$ which is axisymmetric, oscillatory and fixed in space. The resulting solutions show the experimentally observed instability of the stream function and vorticity at Reynolds numbers of 10,000 and 100,000 for a finite-amplitude disturbance, $A_m = 1.0$. The experimentally observed stability at a Reynolds number of 1000 and $A_m = 1.0$ was also found. At a Reynolds number of 3000 and $A_m = 1.0$, a neutral stability effect was noted. For a small-amplitude case, $A_m = 0.1$, at a Reynolds number of 100,000, the solution represents a damped disturbance which is consistent with classical small-amplitude theory. Author

**N69-37609*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.

**COLD-FLOW EXPERIMENTAL INVESTIGATION AND ANALYSIS OF TWO SOURCES OF NOZZLE THRUST MISALIGNMENT**

L. D. Strand and M. W. Dowdy (Martin Co., Baltimore, Md.) 15 Sep. 1969 30 p refs

(Contract NAS7-100)

(NASA-CR-105908; JPL-TR-32-1403) Avail: CFSTI CSCL 20D

Research was performed to investigate the effects of nozzle surface irregularities and throat asymmetry on the rocket-nozzle thrust vector. The program consisted of experimental tests, conducted in a three-dimensional gas-flow test facility, measuring the surface pressure distribution of three test-nozzle configurations, an axisymmetric nozzle, the symmetric nozzle with a protrusion to the flow located in the conical expansion region, and a nozzle with an asymmetrical throat; calculation of the nozzle side forces by summation of the test-pressure data over the nozzle surfaces; comparison of the test data with the results of several simplified flow-field analyses; and the carrying out of a two-dimensional asymmetric nozzle parametric study. From the test results, it was concluded that nozzle surface irregularities and throat asymmetry can produce measurable and possible significant side forces. Guided by the results of the analyses performed, recommendations are made for application of the program results to actual rocket-nozzle conditions. Author

**N69-37610** National Lending Library for Science and Technology, Boston Spa (England).

**APPARATUS FOR MEASURING HYDRAULIC RESISTANCE AND HEAT-TRANSFER IN THE TWO-PHASE FLOW OF HELIUM [USTANOVKA DLYA IZMERENIYA GIDRAVLICHESKOGO COPROTIVLENIYA I TEPLOOTDACHI PRI DVUKH-FAZNOM TECHENII GELIYA]**

V. E. Keilin et al May 1969 14 p refs Transl. into ENGLISH from Russian report

(NLL-RTS-5062) Avail: Natl. Lending Library, Boston Spa, Engl. 27s 6d

A description is given of an apparatus for studying the hydrodynamics and heat-transfer during the flow of helium-4 (liquid, liquid-vapour mixtures and in the super-critical state). Preliminary data are given on the hydraulic resistance and heat-transfer properties during the two-phase flow of helium in a pipe with a diameter of about 0.45 mm and a length of about 1 m. The range of flow rates was from $1.5 \times 10^{-2}$ g/sec to $5.2 \times 10^{-2}$ g/sec, the thermal loadings varied from 0.02 W/cm$^2$ to 0.5 W/cm$^2$ and the vapour content x from 0 to 100%. Data are presented in terms of the hydraulic resistance for two-phase flow. Author

**N69-37622#** Loughborough Univ. of Technology (England). Dept. of Transport Technology.

**A SURFACE VORTICITY METHOD FOR CALCULATING THE PRESSURE DISTRIBUTION OVER AEROFOILS OF ARBITRARY THICKNESS AND CAMBER IN TWO-DIMENSIONAL POTENTIAL FLOW Interim Report**

B. Maskew Apr. 1969 26 p refs

(TT-6907) Avail: CFSTI

An investigation into various surface singularity models in connection with lifting surface research has also produced a surface vorticity method for the solution of the two-dimensional potential flow problem. In this interim report on the method the basic features are briefly discussed in relation to existing surface singularity methods. Pressure distributions predicted by the method are compared with the exact distributions for several aerofoil sections. The method offers greater accuracy than existing surface singularity methods for aerofoil sections of large camber and at high $C_L$ values, but is inaccurate locally in the region of a cusped trailing edge. Author

**N69-37626#** Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
**MEASUREMENTS OF LOCAL HEAT-TRANSFER RATE ON A COOLED SHARP FLAT PLATE IN THE MERGED LAYER FLOW REGIME Final Report, Aug. – Nov. 1968**
David E. Boylan Jun. 1969 60 p refs
(Contract F40600-69-C-0001)
(AD-689177; AEDC-TR-69-71) Avail: CFSTI CSCL 20/4

Results of measurements of the local convective heat-transfer rate on a sharp-leading-edge flat plate at various angles of attack and in the merged layer flow regime are presented. The measurements were obtained using a phase-change temperature-sensitive paint, which greatly simplifies instrumentation requirements, and these measurements were checked using conventional heat-transfer instrumentation. Data obtained on the windward surface at 0-, 10-, and 20-deg angle of attack are compared to theoretical predictions. The data demonstrate the feasibility of utilizing phase-change temperature-sensitive paint in place of conventional heat-transfer instrumentation in low-density high-speed flows. The data at large angles of attack (wedge angles) are shown to correlate in the same manner as the zero angle-of-attack data when local inviscid flow parameters are utilized. Based on local inviscid values, the data are in the Mach number range from 4 to 10 and viscous interaction parameter ranges from 0.06 to 0.80. A strong Mach number influence as well as the nonexistence of a definable strong interaction flow regime in this Mach number range was noted.
Author (TAB)

**N69-37675** British Hydromechanics Research Association, Cranfield (England). Information Dept.
**INVESTIGATION OF THE EFFECT OF THE ENTRY BOUNDARY LAYER ON THE SECONDARY FLOWS IN THE BLADING OF AXIAL-FLOW TURBINES**
A. Klein Apr. 1969 26 p refs Transl. into ENGLISH from Forshung Ing.-Wes. (West Ger.), v. 32, no. 6, 1966 p 175–187
(T-1004) Copyright. Avail: Issuing Activity

Measurements on a circular axial flow cascade of a reaction turbine with large deflection were required to clarify the effect of skewed entry boundary layers on the secondary flows at the blade tips, with special reference to the boundary and clearance losses. In order to obtain this effect isolated from other parameters, the investigation was also extended to the action of a relative motion between the blades and the casing surface; and on a rectangular cascade with the same sections and the same geometry as the axial flow blades, the effect of the entry boundary layer thickness on the edge and gap flows was measured. The measurements showed that the thickness of the entry boundary layer has no influence on the secondary effects. Where the blades are in contact with the casing surface, (zero radial gap), the skewed nature of the entry boundary layer results in a steep increase of the boundary losses. In the case of medium sized wall clearances there is no effect on the secondary losses but they can be considerably reduced by a relative motion between blades and wall. This interaction disappears only at very large clearances.
Author

**N69-37690*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**THE HYDRAULIC CHARACTERISTICS OF FLOW THROUGH MINIATURE SLOT ORIFICES**
Robert W. Riebling and Walter S. Powell 15 Sep. 1969 28 p refs
(Contract NAS7-100)
(NASA-CR-105897; JPL-TR-32-1397) Avail: CFSTI CSCL 20D

The hydraulic characteristics of miniature slot orifices of relatively short length and high aspect (width-to-height) ratio were studied experimentally. The effects of orifice dimensions, surface finish, and flow rates on discharge coefficients and flow regimes were determined. In addition, the stability and visual characteristics of the effluent liquid streams were observed. Orifice surface finish and length-to-height ratio were found to exert a primary influence on hydraulic behavior, and the flow from these devices was predominantly within the transition region. The results are directly applicable to the design of rocket engine injectors incorporating this type of orifice.
Author

**N69-37708#** Asian Inst. of Tech., Bangkok (Thailand).
**CHARACTERISTICS OF FLOW PAST A CIRCULAR DISK PLACED NEAR THE END OF A CIRCULAR PIPE**
Teliang Kung (M.S. Thesis) 1969 95 p refs *Its* No. 249
Avail: CFSTI

Theoretical solutions were obtained from the solutions of the two-dimensional counterpart under the assumption that the final line integration in the two-dimensional case was replaced by the corresponding surface integration. The equations expressing the jet deflection angle, the ratio between the velocity of the uniform flow in the pipe to the velocity of jet, and the coefficient of hydrodynamic drag were obtained as functions of the boundary geometry. The experiments were conducted to verify the theoretical equations. The experimental results for the jet deflection angle and the velocity ratio were found to be less than the theoretical values. However, the trends of the theoretical and experimental curves were very similar. The discrepancies between the theoretical and experimental results of the deflection angle and the velocity ratio were found to be approximately constant for all the values of the dimensionless parameters representing the boundary geometry. Empirical equations were also developed to relate the theoretical and experimental values of the jet deflection angle and the velocity ratio.
Author

**N69-37711*#** Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
**A FUNDAMENTAL INVESTIGATION OF THE PHENOMENA THAT CHARACTERIZE LIQUID-FILM COOLING**
R. A. Gater and M. R. L'Ecuyer Jan. 1969 331 p refs
(Grant NGR-15-005-013; Contract Nonr-1100(21))
(NASA-CR-105904; TM-69-1; JPC-453) Avail: CFSTI CSCL 20D

An experimental investigation was conducted to determine the net rate of mass transfer (evaporation plus entrainment) from a thin liquid film to a proximate gas stream. Three different flow situations were investigated: (1) constant velocity, cold gas flow; (2) constant velocity, heated gas flow; and (3) strongly accelerated, heated gas flow. The experiments were conducted in a horizontal test section by passing an air stream over a liquid film formed on the lower surface. The liquid film was 2-in. wide and was terminated at a length of 10 in. by a knife-edge capture slot. The flow parameters for the experiments with a constant velocity gas stream were: gas stream temperatures of 40F, 400F, and 600F; gas stream static pressures of 75 and 150 psia; gas stream velocities of 40 to 400 fps; and liquid coolants of methanol, butanol, water and RP-1 (a hydrocarbon fuel).
Author

**N69-37747#** Harry Diamond Labs., Washington, D.C.
**FLUERICS. PART 26: THEORY OF TEMPERATURE AND PRESSURE-INSENSITIVE FLUID OSCILLATORS**
Richard Deadwyler Mar. 1969 62 p
(AD-689448; HDL-TR-1422) Avail: CFSTI CSCL 13/7

An analysis has been performed to determine the temperature and pressure dependency of a flueric oscillator. The results of this analysis show that it is possible to cause the charge cycle for a given half period to decrease with temperature and the decay cycle to increase with temperature so that the same net difference flow, which is the switching criterion, can be obtained during each half cycle despite the temperature change. Thus, temperature insensitivity can be accomplished. The parameter design relations for temperature-insensitive operation were found by setting the first derivative to zero. For the network discussed, the second derivative could not be simultaneously set to zero; however, both derivatives can be simultaneously set to zero with a more complex network. A step-by-step procedure for designing a temperature-insensitive flueric oscillator is presented. The analysis is then extended to include pressure insensitivity.
Author (TAB)

N69-37751# Iowa Univ., Iowa City. Inst. of Hydraulic Research.
**SOME ASPECTS OF FLOW-INDUCED VIBRATIONS OF HYDRAULIC CONTROL GATES**
Frederick A. Locher Feb. 1969 197 p refs
(Contract DA-22-079-CIVENG-65-30)
(AD-689457; IIHR-116) Avail: CFSTI CSCL 13/7

High-head gates in dams and outlet works, was the principal concern of the investigation. The geometrical configuration chosen for the study is a highly idealized representation of a flat-bottomed, high-head gate just protruding into the flow--in effect, a normal wall or step. The primary objectives of the research were to investigate how basic flow instabilities associated with a free shear layer may lead to flow-induced vibrations of high-head gates, and to relate the mechanisms elucidated by the study of the idealized gate geometry to a general classification of flow-induced excitations. Author (TAB)

N69-37764# Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Group.
**PARAMETERS IN FLUID FLOW THROUGH A MANIFOLD**
E. Zsayman Jan. 1968 35 p refs
(CHEM-69) Avail: CFSTI

In experiments with a transparent blowing manifold having only a few laterals, flow patterns were recorded photographically and the pressure distribution was measured. It was shown that the Acrivos equation for pressure recovery at a lateral is more practical than the more sophisticated Powell equation. There are indications that the data obtained are applicable to larger manifolds. To ascertain this, it is recommended that similar experiments be carried out on a combined blowing-sucking manifold with a large number of laterals. Author

N69-37771# Wisconsin Univ., Madison. Mathematics Research Center.
**ON CERTAIN MOTIONS WITH CONSTANT STRETCH HISTORY AND THEIR RELATED VELOCITY PROFILES IN INCOMPRESSIBLE NEWTONIAN AND SECOND ORDER FLUIDS**
R. R. Huilgol Jan. 1969 31 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-689415; MRC-TSR-959) Avail: CFSTI CSCL 20/4

Seven motions with constant stretch history of which three are viscometric flows, two are doubly superposed viscometric flows and the remaining two are triply superposed viscometric flows are considered and their velocity profiles are determined for incompressible Newtonian and second order fluids. A description of a helical-torsional flow rheometer is also given and this device can be used to determine the material functions occurring in doubly superposed viscometric flows. Author (TAB)

N69-37788# Harry Diamond Labs., Washington, D.C.
**REVIEW OF SOME FLUID OSCILLATORS**
Carl J. Campagnuolo and Henry C. Lee Apr. 1969 44 p refs
(AD-689445; HDL-TR-1438) Avail: CFSTI CSCL 13/7

Fluid oscillators of various types have been developed and applied to fluidic systems for sensing or missile control. The operating characteristics of these oscillators, including the dependence of the frequency on the stagnation pressure and temperature, are a function of the type of return loop employed for maintaining oscillations. This report discusses and summarizes the operating principles, design, frequency variation, and applications of some of the most prominent oscillators such as: The sonic, lumped R-C-R and L-R, edgetone, ringtone, and vortex oscillators. Author (TAB)

N69-37804# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Berlin (West Germany). Inst. fur Turbulenzforschung.
**ON THE STABILITY OF FREE SHEAR LAYERS IN COMPRESSIBLE FLUIDS [BEITRAG ZUR STABILITAET FREIER GRENZSCHICHTEN IN KOMPRESSIBLEN MEDIEN]**
H. Gropengiesser (Ph.D. Thesis--Berlin Univ.) May 1969 122 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-25; DVL-867) Avail: CFSTI

The stability of free shear layers which are observed in jet flows and in the wake behind blunt bodies is discussed. The investigation of the inviscid stability properties was carried out for a laminar velocity profile which develops from a compressible vortex layer under the influence of viscosity. The amplification and the phase velocity of disturbances with a small amplitude were computed as a function of the disturbance frequency and the angle of wave propagation for various Mach numbers and temperature ratios. The phase velocity of the disturbance relative to the local flow may be either less or greater than the speed of sound. Accordingly the character of the disturbance is classified as subsonic or supersonic. It is found that a change of the character of the disturbance may cause the amplification of a second mode. Author (ESRO)

N69-37808# General Dynamics Corp., Groton, Conn. Electric Boat Div.
**AN EXPERIMENTAL INVESTIGATION OF THE TURBULENT CHARACTERISTICS OF A BOUNDARY LAYER FLOW OVER A VIBRATING PLATE**
Anthony J. Izzo 1 May 1969 32 p refs
(Contract Nonr-2512(00))
(AD-689202; U417-69-049) Avail: CFSTI CSCL 20/4

Measurements of the spectral density of the axial component of turbulent velocity were made in a boundary layer when the surface beneath it was vibrating in a deterministic manner. These measurements indicated that a narrow-band disturbance resulted from the plate motion. The spectral density of the axial turbulent velocity, at the surface excitation frequency, exhibited a marked increase in magnitude when the surface was being excited. The ratio of the spectral density with and without plate excitation was measured throughout the boundary layer within the region of the vibrating surface. These measurements indicated that the disturbance produced by the surface motion is convected downstream where it is reinforced if it comes into a region which is influenced by a portion of the plate that has an amplitude of vibration greater than the upstream portion. This reinforcement phenomenon was observed for every test condition in which the test plate excitation was a mode where two or more displacement crests appeared in the longitudinal direction. Observations of the transverse variation of the disturbance conclude that there is an absence of any transverse convection nature. Author (TAB)

N69-37819# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
**ASYMPTOTIC LIMITING SOLUTIONS IN NON-EQUILIBRIUM EXPANDING FLOWS**
P. A. Blythe Mar. 1969 25 p refs
(Contract DAAD05-69-C-0053; Proj. Themis)
(AD-689481; CAM-110-3) Avail: CFSTI CSCL 20/4

The existence and location of de-excitation shocks in near-frozen non-equilibrium expanding nozzle flows is discussed for a general family of rate processes. Possible asymptotic limiting solutions are obtained for power-law nozzle shapes when the rate function adopts a simple separable form. It is shown that under certain circumstances it is the initial magnitude of the rate parameter that controls the asymptotic behavior. Author (TAB)

N69-37852*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
**MEASUREMENTS OF TURBULENT BOUNDARY LAYERS ON A HEAT-INSULATED WALL IN THE SMALL SUPERSONIC WIND TUNNEL OF THE AVA [MESSUNGEN VON TURBULENTEN GRENZSCHICHTEN AN EINER WAERMEISOLIERTEN WAND IM KLEINEN UEBERSCHALLWINDKANAL DER AVA]**

Hans Ulrich Meier Washington NASA Sep. 1969 17 p refs Transl. into ENGLISH from Z. Fuer Flugwiss. (West Ger.), v. 17, Jan. 1969 p 1-8
(Contract NASw-1692)
(NASA-TT-F-12547) Avail: CFSTI CSCL 20D

Experimental investigation of the turbulent boundary layers which develop on the flat wall of a small supersonic wind tunnel was conducted. Total pressure distributions were measured at three different distances from the nozzle at Mach numbers ranging from 1.5 to 3. The velocity profiles and the various boundary layer thicknesses were determined under the assumption of adiabatic wall conditions. The local skin friction coefficients were calculated from the momentum equilibrium and the wall law. Author

**N69-37870#** California Univ., Berkeley. Div. of Aeronautical Sciences.
**THE EFFECTS OF EMPIRICAL DISSIPATION TERMS IN THE SOLUTION OF THE UNDULAR BORE**
John G. B. Bayatt-Smith Apr. 1969 44 p refs
(Contract Nonr-222(79))
(AD-688153; AS-69-9) Avail: CFSTI CSCL 8/3

In this paper we consider the problem of a steady bore running downhill. The effects of dissipation are included empirically using the Chezy Law. The method of solution is based on an averaging technique which assumes that the uniform solution is slowly varying. Author (TAB)

**N69-37871#** Ballistic Research Labs., Aberdeen Proving Ground, Md.
**OPERATION CYCLE OF EXPANSION TUBE WITH NOZZLE PLATE**
Nathan Gerber and Joan Bartos Jun. 1969 32 p refs
(AD-689540; BRL-MR-1982) Avail: CFSTI CSCL 14/2

The report presents an analysis of the operation cycle of an expansion tube with a nozzle plate located at the secondary diaphragm. Analyses are given for two situations: (1) the secondary diaphragm breaks instantly, and (2) it breaks after a delay due to finite mass. Equations are developed applicable to real gas in thermodynamic equilibrium in the driven and expansion sections of the tube. A discussion of numerical and graphical computational procedures is presented and calculations for air are shown for cases representative of operating conditions. Author (TAB)

**N69-37872#** Aerospace Research Labs., Wright-Patterson AFB, Ohio. Fluid Dynamics Facilities Research Lab.
**CASCADE TESTING OF SUPERSONIC COMPRESSOR BLADE ELEMENTS Final Report**
Ronald L. Haugen and John W. Steurer Feb. 1969 74 p refs
(AD-689822; ARL-69-0034) Avail: CFSTI CSCL 13/7

An experimental study was made of the aerodynamic behavior of a series of supersonic compressor blade elements. A two-dimensional cascade facility permitted the measurement of the mid-passage static pressure rise and the wake total pressure distribution. From these measurements the mass averaged total pressure recovery and loss coefficients were evaluated. Flow visualization studies were also performed. Comparisons between the measured loss parameters and simplified loss prediction techniques were made. For small values of the diffusion factor (and in this case where shock losses are relatively small) one may approximate the loss processes by summing the dump diffusion losses and the Lieblein loss correlation. At higher diffusion factors (and as shock losses become more important) a better correlation can be obtained by summing shock losses and the dump diffusion losses. In an effort to minimize the dump diffusion losses, the trailing edge of each blade design was modified. The resulting total pressure and loss parameters exhibit marked improvement. Author (TAB)

**N69-37915#** Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
**ANALYTICAL INVESTIGATIONS OF EQUILIBRIUM AND NONEQUILIBRIUM COMPRESSIBLE TURBULENT BOUNDARY LAYERS**
Irwin E. Alber and Douglas E. Coats May 1969 58 p refs
(Contract N00014-67-A-0226)
(AD-689519; SQUID-TR-DYN-1-PU) Avail: CFSTI CSCL 20/4

An integral method is presented for the adiabatic compressible turbulent boundary layer which extends recent concepts of turbulent equilibrium boundary layers to the study of nonequilibrium flows. Coles law of the wall and wake is extended to the case of compressible adiabatic flows with pressure gradient by employing Van Driests generalized velocities. An analytical expression for the compressible turbulent equilibrium dissipation integral is then derived from the integral momentum, mean energy and local skin friction equations. For the general case of nonequilibrium flows with arbitrary pressure gradients, the dissipation integral is unhooked from the equilibrium pressure gradient parameter through the use of a single empirical curve of existing incompressible flow data. Numerical solutions are then presented for a variety of compressible flows. As a first step in developing an integral method for nonadiabatic flows, the family of incompressible equilibrium enthalpy profiles are solved for from the thermal energy equation. Author (TAB)

**N69-37935#** Advisory Group for Aerospace Research and Development, Paris (France).
**A PORTFOLIO OF STABILITY CHARACTERISTICS OF INCOMPRESSIBLE BOUNDARY LAYERS**
H. J. Obremski (Martin Marietta Corp., Baltimore, Md.), M. V. Morkovin (IIT, Chicago, Ill.) and M. Landahl (Roy. Inst. of Tech.) Mar. 1969 134 p refs Sponsored by Fluid Dyn. Panel of AGARD-NATO
(AGARDOGRAPH-134) Avail: CFSTI

A collection of linear amplification and propagation rates (temporal and spatial) for two similar and non-similar families of boundary layers is presented in graphical and tabular form. Their usage is illustrated for tracing the growth of disturbances in a flat-plate boundary layer which develops in x and varies periodically with t. If a user of the Portfolio can match the U''(y) distribution of his profile with that of a Portfolio profile over the central 80% of the boundary layer, the stability characteristics of the matched profile seem to provide him with satisfactory approximations for those of his own profile. The utilization of the Portfolio information for estimating transition Reynolds numbers is discussed. Analysis of the numerical variations of stability characteristics with various features of the related profiles clarifies the role of U''(y) and of the location of the inflection point. The usual shape factor H emerges as the only simple parameter capable of correlating satisfactorily the minimum critical Reynolds number for non-similar profiles. Author

**N69-37953#** Argonne National Lab., Ill. Applied Mathematics Div.
**CALCULATION OF STEADY PLANE AND AXISYMMETRIC SUPERSONIC GAS FLOWS CONTAINING AN ARBITRARILY LARGE NUMBER OF SHOCKS**
David B. Taylor Oct. 1968 176 p refs
(Contract W-31-109-ENG-38)
(ANL-7491) Avail: CFSTI

A method is described that will yield a weak solution of the plane or axisymmetric supersonic-gas-flow equations. In regions of continuity, integration along characteristics is used to determine the solution on successive normals to the streamlines of the flow. Special techniques are presented to introduce and keep track of the arbitrarily large number of shocks, slip lines, and discontinuities of gradient which arise when the boundaries of the flow are specified with arbitrary piecewise continuity. The methods given

may be adapted to determine weak solutions of other hyperbolic systems with two independent variables. Author (NSA)

N69-37965*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**INJECTION OF AN INVISCID SEPARATED JET AT AN OBLIQUE ANGLE TO A MOVING STREAM**
Marvin E. Goldstein and Willis Braun Washington Oct. 1969 72 p refs
(NASA-TN-D-5460) Avail: CFSTI CSCL 20D

An analytical solution has been obtained to the problem of a two-dimensional incompressible jet injected into a moving stream from an orifice set at an oblique angle to the stream. It is assumed that the jet separates from the downstream edge of the orifice. The solution is valid when the normalized difference between the total pressure in the jet and the total pressure in the main stream is not too large. Typical flow patterns are shown to illustrate the effects of varying both the jet offset ratio and the total pressure within the jet. Author

N69-38012*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**DISCHARGE COEFFICIENTS FOR THICK PLATE ORIFICES WITH APPROACH FLOW PERPENDICULAR AND INCLINED TO THE ORIFICE AXIS**
John E. Rohde, Hadley T. Richards, and George W. Metger Washington Oct. 1969 30 p refs
(NASA-TN-D-5467) Avail: CFSTI CSCL 20D

Experimental discharge coefficients were obtained for thick plate orifices with the approaching flow perpendicular or inclined to the orifice axis. Parameters investigated were temperature and pressure levels; orifice pressure differential; approach Mach number; orifice diameter, thickness, and inlet edge condition; orifice surface finish; interference of multiple orifices; and approach passage geometry and length. The discharge coefficients were found to be dependent on approach Mach number, static pressure differential across the orifice, inlet edge radius on the orifice, angle between the main flow and the axis of the orifice, and the ratio of the orifice thickness to diameter. Author

N69-38031# Advisory Group for Aerospace Research and Development, Paris (France).
**THE ELECTRON BEAM FLUORESCENCE TECHNIQUE**
E. P. Muntz (GE, Philadelphia, Pa.) Dec. 1968 123 p refs
(AGARDOGRAPH-132) Avail: CFSTI

Development and application of the electron beam fluorescence technique for the study of gas flows are discussed. Present understanding of the technique is reviewed. Areas are indicated where further work is most needed. The practical employment of the technique is described by presenting brief reviews of the approximately 80 papers that have been published on its development and applications. Author

N69-38032*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**MOTION OF SINGLE BUBBLES UNDER LOW GRAVITATIONAL CONDITIONS**
John B. Haggard, Jr., and William J. Masica Washington Oct. 1969 32 p refs
(NASA-TN-D-5462) Avail: CFSTI CSCL 20D

An experimental study was undertaken to examine single, noncondensable bubble motion under low-gravity conditions. These data were compared with normal-gravity theory and empirical results. The M number (a characteristic dimensionless parameter containing gravity and the liquid properties) was found to be a significant parameter in correlating normal- and low-gravity data. This report, together with normal-gravity theory, predicts bubble shape and terminal velocity when the liquid properties, the bubble volume, and the applied gravity field are known. The results are applicable to a range of spherical and ellipsoidal bubbles with Reynolds numbers above 50. Author

N69-38071# Lockheed Missiles and Space Co., Palo Alto, Calif.
**COMPLETELY CONSERVATIVE DIFFERENCE SCHEMES**
Iu. P. Popov et al 1969 8 p refs Transl. into ENGLISH from Vychisl. Matem. i Matem. Fiz. (USSR), v. 9, no. 4, 1969 p 953-958
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A new set of difference schemes is offered to be applied to the system of gas dynamics equations. They are to be called completely conservative difference schemes if both the mass, momentum, and total energy conservation laws are valid, and the detailed energy balance (internal and kinetic) is valid simultaneously. With a known integro-interpolation method and a formal selection rule, the difference schemes can be obtained. This is the rule: these schemes should possess the same property as the necessary system of differential equations; in other words, the nondivergent energy difference equation should reduce, to the divergent difference equation by using the remaining difference equation, and conversely. The scheme is demonstrated in a limiting discussion restricted to the case of uniform meshes. Herein, a cross difference scheme for one-dimensional gas dynamics problems is executed. The stability of the schemes is not demonstrated because of the implicit stability of the completely conservative schemes. M.H.E.

N69-38107# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**STATIONARY-LIQUID CLASSIFICATION AND STUDY OF FIXED STATIONARY LIQUIDS IN GAS CHROMATOGRAPHY**
Wei-lo Yu, K. O-Wei Tseng, Tsu-Fang Lu, and P'ei-i Yang Mar. 1969 18 p refs Transl. into ENGLISH from the Chinese
(AD-689815; FTD-HT-23-1348-67) Avail: CFSTI CSCL 7/4

The paper presents a classification of 19 different stationary fluids that are used in gas chromatography according to their respective relative polarities as determined in reported laboratory experiments. The relative polarities and separating powers of some mixed stationary fluids as well as the dependence of separating power on length of column were also investigated. Author (TAB)

N69-38128*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**OPTICAL PROBING OF SUPERSONIC AERODYNAMIC TURBULENCE WITH STATISTICAL CORRELATION. PHASE 1: FEASIBILITY**
B. H. Funk, Jr. and H. A. Cksnak, Jr. (Northrop Corp., Huntsville, Ala.) 9 Jun. 1969 144 p refs
(NASA-TM-X-53850) Avail: CFSTI CSCL 20D

The feasibility of measuring statistical properties of supersonic aerodynamic turbulence by statistical correlation of signals remotely retrieved by optical probing without the use of tracers is investigated. Theoretical analyses and qualitative experimental results are presented concerning the application of laser quasi-schlieren and laser shadow-correlation remote-sensing systems. Cross-correlation measurements made on-line with parallel and crossed beams are shown and discussed. A one-shot statistical correlation concept is introduced and experimentally verified that allows the time-history of the decay of turbulent structures to be computed from a single composite signal and displayed on an oscilloscope while data are being retrieved. Author

N69-38158*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**FLOW-FIELD AND DRAG CHARACTERISTICS OF SEVERAL BOUNDARY-LAYER TRIPPING ELEMENTS IN HYPERSONIC FLOW**
Allen H. Whitehead, Jr. Washington Oct. 1969 40 p refs
(NASA-TN-D-5484) Avail: CFSTI CSCL 20D

Flow field and drag characteristics of several tripping-element

shapes were examined under laminar boundary layer conditions at a free-stream Mach number of 6.8 to assess the contribution of the elements to the drag of wind tunnel models and to examine flow field characteristics around individual element shapes. The element drag coefficient based on local conditions depends primarily on element shape, the spacing between the elements, and the ratio of the element height to boundary layer height. Advantageously, certain element shapes have drag coefficients which are relatively independent of the ratio of element height to boundary layer height for values of this ratio that have practical application for hypersonic wind tunnel facilities. Author

**N69-38171#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**MIXED THREE-DIMENSIONAL GAS FLOW IN A LONGITUDINAL MAGNETIC FIELD**
V. B. Gorskii [1969] 5 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekh. Fiz. (USSR), no. 2, 1969 p 34-37
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Three dimensional, mixed gas flows with infinite conductivity in a longitudinal magnetic field are considered. Approximate equations for the magnetic potential of the perturbation velocity are found by the method of small perturbations for all possible mixed flows, and some of their particular integrals are obtained. Author

**N69-38173*#** TRW Systems Group, Redondo Beach, Calif.
**ZERO GRAVITY LIQUID-GAS SEPARATOR-ENGINEERING EVALUATION MODEL Final Report, 9 Jun. - 19 Sep. 1969**
19 Sep. 1969 14 p refs
Contract NAS9-9525)
NASA-CR-101928; TRW-13288-6001-R0-00) Avail: CFSTI CSCL 20D

The operating principles for an engineering evaluation model of a zero gravity, liquid-gas separator are described, as well as the design of the actual device delivered during the reporting period. A brief treatment of the predelivery acceptance test and its results is also included. Author

**N69-38187#** Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
**AN EXPERIMENTAL DETERMINATION OF THE TRANSITION TO TURBULENCE USING THE ELECTRIC DOUBLE LAYER Final Report**
Knox T. Millsaps, Roland C. Anderson, and James E.Milton Apr. 1969 188 p refs
(Grants AF-AFOSR-842-65; AF-AFOSR-842-67)
(AD-689289; AFOSR-69-1460TR) Avail: CFSTI CSCL 20/4

The research work done on this grant consists of developing an electrical method for the detection of the transition from laminar to turbulent flow in fluids and the application of this technique to several flow systems. The method depends on the existence of a electric double layer at the interface between a solid surface and an electrolyte. When the electrolyte is caused to flow in a glass tube a potential, streaming potential, will be developed between the ends of the tube. By monitoring this potential it is possible to ascertain the transition Reynolds number. This was done for both a straight and a curved circular pipe. In the case of the straight pipe the minimum critical Reynolds number was found to be 1907 plus or minus 3 and in a pipe with a radius of curvature of 55.9 inches the transition Reynolds number was found to be 3910 plus or minus 10. By varying the concentration of the electrolyte it is possible to vary the thickness of the electric double layer and therefore the region of the flow that is being examined. A study of this type, with double layer thickness varied from several thousand A to several hundred A, was done. It was found that the transition Reynolds number was increased by an increase in the double layer thickness. Author (TAB)

**N69-38216#** United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.
**STUDIES OF TWO-PHASE FLOW PATTERNS BY SIMULTANEOUS X-RAY AND FLASH PHOTOGRAPHY**
G. F. Hewitt and D. N. Roberts Feb. 1969 28 p refs
(AERE-M-2159) Avail: CFSTI; HMSO: 7s

Studies are reported of the flow patterns in vertical upward flow of air-water mixtures in a 1-1/4 inch bore tube at pressures ranging from 6 to 65 psig. The flow pattern was observed by means of simultaneous high speed flash and high speed X-ray photography. Particular attention was paid to the region of high liquid rates where ordinary photographic methods are inadequate. The development of macroscopic structure within the flow leading to annular and wispy annular flow was clearly demonstrated. Author (NSA)

**N69-38219#** Naval Ship Engineering Center, Washington, D.C.
**A BULK CAVITATION THEORY WITH A SIMPLE EXACT SOLUTION**
G. V. Waldo, Jr. Apr. 1969 25 p refs
(AD-689790; NSRDC-3010) Avail: CFSTI CSCL 19/4

A theory of bulk cavitation is presented in which an equation governing the motion of the water surface is derived. This equation is found to have a simple exact solution with which calculations can be performed without a computer. This solution not only yields the results of Walker and Gordon for the closure depth and time, but also predicts the complete surface velocity history rather than just a straight line model of the surface velocity history. Simple exact equations for the surface slab thickness history and the surface displacement history are also derived. The theory is found to be physically plausible and is in reasonable agreement with the experimental data of Walker and Gordon. Author (TAB)

**N69-38238#** Naval Ship Research and Development Center, Washington, D.C. Hydromechanics Lab.
**FLUTTER AND CAVITY-INDUCED OSCILLATION OF A TWO-DEGREE-OF-FREEDOM HYDROFOIL IN TWO-DIMENSIONAL CAVITATING FLOW Final Report**
Peter K. Besch Apr. 1969 65 p refs
(AD-690096; NSRDC-3000) Avail: CFSTI CSCL 13/10

Two hydrofoil flutter tests were performed using a two-degree-of-freedom, semiwedge hydrofoil in two-dimensional cavitating flow. In the first test, conducted in the high-speed towing basin, four distinct cavity lengths were tested. Flutter occurred for cavities 1/2 and several chords in length. Cavity-induced oscillations may have occurred for 1-chord cavities, but no oscillations were observed for 2-chord cavities. The flutter results are compared with flutter boundaries predicted by partially cavitating and supercavitating flutter theories. It is concluded that the experimental flutter results do not disagree with the predicted values. In the second test, conducted in the 24-in. variable-pressure water tunnel, cavity lengths were varied from 0 to 3 chords. Cavity-induced oscillations were observed for cavities between 0.4 and 1.4 chords in length, but other cavity lengths were free of oscillation. The oscillations are discussed in terms of forced oscillations of a coupled two-degree-of-freedom elastic system. It is concluded that the cavity-induced oscillations, unlike flutter, are positively damped oscillations. Author (TAB)

**N69-38239#** Naval Ship Research and Development Center, Washington, D.C. Acoustics and Vibration Lab.
**GENERAL PRESSURE DISTRIBUTION FOR AN OSCILLATING SPHERE FLOATING IN A FLUID OF FINITE DEPTH**
Erwin L. W. Paul Mar. 1969 41 p refs
(AD-690094; NSRDC-2942) Avail: CFSTI CSCL 20/4

The general pressure field caused by a heaving sphere floating half submerged in a fluid of finite depth is calculated. A sphere oscillating in an unbounded fluid develops a dipole pressure field. When oscillating on the free surface of a fluid, however,

damping and buoyancy forces change the pressure field which now comes under monopole influence as well. The high- and low-frequency limits of singularities in an infinite fluid define the surface conditions for a bounded fluid. The general intermediate frequency case is considered, whereby the pressure field is related to the forces acting on the sphere. Author (TAB)

N69-38289# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

**TWO-PHASE FLOW AND HEAT TRANSFER IN MULTIROD GEOMETRIES. AIR-WATER FLOW STRUCTURE DATA FOR A ROUND TUBE, CONCENTRIC AND ECCENTRIC ANNULUS, AND NINE-ROD BUNDLE**

F. A. Shraub, R. L. Simpson, and E. Janssen Jan. 1969 214 p refs

(Contract AT(04-3)-189)

(GEAP-5739) Avail: CFSTI

The equipment and instrumentation for flow structure experiments of vertically upward air-water flow in a round tube, eccentric and concentric annulus, and a nine-rod array are discussed. The following quantities were measured for a series of runs: at one elevation, profiles of local void fraction, air linear velocity, and water linear velocity were obtained (isokinetic sampling technique); the film flow rate on solid surfaces (porous or perforated walls); local time-dependent liquid or vapor fraction (continuity probe); average void fraction (quick-closing valves); system temperature, pressure, and pressure fluctuations (thermocouples, Bourdon gage, and PACE transducers); mean air and water flow rates (rotometer and orifice and manometer, respectively); pressure drop (manometers); and wall shear probe (Preston impact tube). The quality varied from 11 to 62%. The total mass flow ranged from $0.12 \times 10^6$ to $0.70 \times 10^6$ lb/hr ft$^2$, resulting in superficial air velocities from 48 to 72 ft/sec and superficial water velocities from 7 to 23 ft/sec. Author (NSA)

N69-38301# Naval Postgraduate School, Monterey, Calif.

**DRAG OF FREE-FALLING SPHERES IN DILUTE AQUEOUS SOLUTIONS OF POLY(ETHYLENE OXIDE) FOR REYNOLDS NUMBERS ABOVE THE CRITICAL VALUE**

Edgar Franklin Woolery (M.S. Thesis) Dec. 1968 91 p refs

(AD-689724) Avail: CFSTI CSCL 13/10

Drag of free-falling spheres in water and in dilute aqueous solutions of poly(ethylene oxide) was measured by ejecting the spheres near terminal velocity in a fluid-filled tank. Polymer additive concentrations tested were 1000 wppm, 200 wppm, and 100 wppm. The results agree with previous investigations, available only for subcritical Reynolds numbers, in that the drag coefficient decreases with increasing water Reynolds number and decreasing polymer concentration. It is shown that in the polymer solutions abrupt decrease in drag coefficient occurs at about the same Reynolds number 300,000 as the critical value in water. For Reynolds numbers greater than the critical value, the drag was still less than in water and increased slightly with increasing polymer concentration. At Reynolds numbers between 7 and 800,000, the drag coefficients for all polymer concentrations, including water, abruptly increased to nearly a common value at the upper limit of this investigation. Author (TAB)

N69-38309# Los Alamos Scientific Lab., N.Mex.

**GENERALIZED TRANSPORT THEORY OF ANISOTROPIC TURBULENCE**

Francis H. Harlow and Cyril W. Hirt 19 Jan. 1969 19 p refs

(Contract W-7405-ENG-36)

(LA-4086) Avail: CFSTI

Turbulence flux approximations, previously used in transport equations for an eddy viscosity function, are used to derive similar equations for the Reynolds stress. Both this and the associated transport equation for scale are written in universal, invariant form for application to a wide scope of time-dependent problems in arbitrary configuration. Several aspects of the derivation are discussed and some properties and solutions of the equations described. Author (NSA)

N69-38312# Brookhaven National Lab., Upton, N.Y. Information Div.

**HYDRODYNAMICS OF A TWO-PHASE FLOW OF POTASSIUM IN TUBES**

I. T. Aladev Apr. 1968 34 p refs Transl. into ENGLISH from the Publ. "Gidrodynamika Dvukhsazovogo Potoka Kaliya v Grubakh" Moscow, Nauka, 1968 p 1-34

(BNL-tr-267) Avail: CFSTI

The true volume vapor quality and hydraulic resistance for adiabatic flow of potassium vapor in tubes are reported. The difference in the physical properties of the vapor and liquid phases and the flow dynamics determine the relative velocity of the phase, i.e., the slip. Characteristics of the slip were studied experimentally by measuring the true volume vapor quality of the flow. Semiempirical equations are derived for the calculations of the true vapor quality and the resistance of the K vapor flow. NSA

N69-38353# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.

**STUDIES OF THE BEHAVIOUR OF DISTURBANCE WAVES IN ANNULAR FLOW IN A LONG VERTICAL TUBE**

L. E. Gill, G. F. Hewitt, and D. N. Roberts Mar. 1969 22 p refs

(AERE-R-6012) Avail: CFSTI; HMSO: 3s 6d

Measurements of the velocity and frequency of disturbance waves in vertical upward annular flow were made for a variety of gas velocities and pressures at a number of distances from the liquid injection point ranging up to 55 ft. It was shown that, for a given distance between the injector and the measurement point, the wave frequency and velocity were independent of the length for gas flow upstream of the injector and the length for two phase flow downstream of the injector. This confirmed the reproducibility of the wave phenomenon and eliminated one possible source of inconsistency in area data. It was also shown that the wave frequency and wave velocity became constant, independent of the distance from the liquid injector. It was found that, for a given gas velocity, both wave frequency and wave velocity increased with increasing gas density. Experimental work described was carried out using air - water flow in a vertical 1.25 in. bore tube. Entrainment, film thickness and pressure gradient data were obtained and are given for reference purposes. Author (NSA)

N69-38354# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.

**THE LOTUS (LONG TUBE SYSTEM) AIR-WATER LOOP DESIGN AND DESCRIPTION**

D. N. Roberts Feb. 1969 21 p refs

(AERE-M-2175) Avail: CFSTI; HMSO: 3s 6d

The LOTUS loop has been operating at Harwell for over five years and a wide range of experimental work has been performed on it. The main object of the rig was to allow the study of vertical two-phase flows in channels of long length (the maximum length is 77 feet). Background information on the loop is presented, which supplements that given in individual reports on the experimental work. Author (NSA)

N69-38388# United Kingdom Atomic Energy Authority, Harwell (England). Atomic Energy Research Establishment.

**MINIMUM FLUIDISATION VELOCITIES FOR SPHERICAL AND IRREGULAR PARTICLES FLUIDISED BY AIR**

B. A. Partridge and E. Lyall Mar. 1969 21 p refs

(AERE-M-2152) Avail: CFSTI; HMSO: 4s

The minimum fluidization velocity and bed voidage were measured for shallow beds of closely sized glass spheres and irregular sand particles in the range 3000 to 60 μm fluidised by air. The observations with glass spheres were consistent with the

Kozeny-Carman equation for flow through packed beds of spheres, and at minimum fluidization gave a mean value of the Kozeny constant very close to the generally accepted value of 4.8 which has been found to apply to beds in which the spheres are randomly packed. Author (NSA)

**N69-38413#** Gulf General Atomic, San Diego, Calif.
**EXPERIMENT ON GAS MIXING IN A CROSS-FLOW TUBE BUNDLE**
L. E. Efferding and J. F. Landa 15 Jan. 1969 60 p refs
(Contract AT(04-3)-633)
(GAMD-8768) Avail: CFSTI

Tests were performed to determine the amount of gas-side mixing between a hot gas stream and the ambient flow during cross-flow through an in-line bundle; excess flow (gas bypass) around the tube bundle via the channel between the outside row of tubes and the wall; and the effectiveness of the tube bundle in uniform flow resistance in smoothing inlet gas velocity distortions. Significant levels of gas mixing during cross-flow were measured. A nominal mixing coefficient of 0.10 was indicated at the steam generator operating Reynolds number of 40,000. Problems in steam generator such as operating with plugged tubes are eased when the mixing effect is considered. Gas bypass around the tube bundle along the wall is negligible. Several inlet velocity distortions introduced to the test bundle were smoothed after six rows showing that the tube bundle acts as an effective screen. The reheater bundle should smooth any inlet gas velocity streaks. A flow anomaly which affects the exit velocity profile appears to be a characteristic common to cross-flow geometry. NSA

**N69-38441#** Cambridge Univ. (England). Dept. of Engineering.
**MEASUREMENTS OF SECONDARY FLOW IN THE BOUNDARY LAYERS OF A 180 DEGREE CHANNEL**
V. C. Patel London HMSO 1969 23 p ref Supersedes ARC-30428
(ARC-CP-1043; ARC-30428) Copyright. Avail: CFSTI; HMSO 5s 6d

Secondary flow measurements have been made within the turbulent boundary layers at two streamwise cross-sections of a 180 degree curved channel. The results indicate substantial three-dimensionality on all four walls of the channel. The secondary flows on the flat and convex surfaces are in accordance with those expected from considerations of the action of the centrifugal pressure gradients on the flat surfaces, while those on the concave surface appear to be dictated both by this effect as well as by the occurrence of longitudinal instability vortices. Some attempts have been made to reduce the cross-flows on the curved surfaces so that the influence of streamwise surface curvature on nominally two-dimensional turbulent boundary layers can be investigated. Author (ESRO)

**N69-38471** California Univ., Livermore. Lawrence Radiation Lab.
**HYDROSTATIC PRESSURE CELL FOR PRESSURE-VOLUME MEASUREMENTS TO 5 KILOBARS**
Harry B. Keller 12 May 1969 15 p refs
(CRUL-50611) Avail: CFSTI

A liquid high-pressure system to provide pressure-volume (PV) data to 3 kilobars has been developed and tested on representative samples of tuff (both dry and water-saturated) and oil shale. The methods of calibration and data reduction are discussed and a comparison is made between the present data and earlier data taken on similar samples using an all solid system. Since shear forces are absent in liquids, the system provides a truly hydrostatic environment and an expectation of low-pressure PV data of better quality for samples of all kinds. Author (NSA)

**N69-38548#** Centro Informazioni Studi Esperienze, Milan (Italy).
**TWO-PHASE (GAS/LIQUID) ADIABATIC VERTICAL UP-FLOW: A PRELIMINARY STUDY WITH A ROD CLUSTER GEOMETRY**
P. Aita, L. Cravarolo, A. Hassid, and E. Pedrocchi Mar 1968 82 p refs Supported jointly by US-EURATOM *Its* Topical Report No. 19
(Contract EURATOM-060-61-7 RDI)
(EURAEC-1090; EUR-3997; CISE-R-108) Avail: CFSTI

The hydrodynamics of two-phase (gas-liquid) systems in annular-dispersed flow with a rod bundle geometry were investigated. The thickness of the film region at the pressure tube and rod walls and the pressure drop and density were investigated. A schematic flowsheet of the testing circuit is given. NSA

# 13 GEOPHYSICS

**Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.**

**N69-37220*#** Wisconsin Univ., Madison. Dept. of Chemistry.
**NEUTRON ACTIVATION ANALYSIS FOR RARE EARTHS (LANTHANIDES AND YTTRIUM) ON SIMULATED LUNAR SAMPLES Final Report**
Larry A. Haskin May 1969 80 p refs
(Contract NAS9-7975; Grant NGR-50-002-041)
(NASA-CR-101903) Avail: CFSTI CSCL 08G

Details and evaluation of a procedure are given for neutron activation analysis of the rare earths, based on separation of that element group from rocks and minerals and radioassay with a Ge – Li detector. Results for basaltic, intermediate, and rhyolitic rocks from the Stretishorn dike, Eastern Iceland, are presented and discussed in the light of recent geochemical studies for other elements in that body. Further development of procedures for analysis of 40 elements by neutron activation, also based on element group separations and Ge – Li gamma-ray spectrometry, is discussed. Results obtained by this procedure are presented for 6 whole-rock chips and 4 separated phases from the Bruderheim meteorite. Author

**N69-37222#** Grumman Aircraft Engineering Corp., Bethpage, N.Y. Geo-Astrophysics Div.
**MANNED SUBMERSIBLE OPTICAL REMOTE SENSING WITHIN THE GULF STREAM**
Walter G. Egan Sep. 1969 17 p refs Presented at 6th Symp. on Remote Sensing of Environment, Ann Arbor, Mich., 14 – 16 Oct. 1969
(RM-455J) Avail: CFSTI

Three optical remote sensing experiments have been installed on the Ben Franklin, a 48-foot-long manned submersible. They are designed to measure: (1) chlorophyll; (2) minerals/gelbstoff; and (3) bioluminescence. This summer the submersible pursued a 30-day Gulf Stream drift mission at depths up to 2000 feet, starting at West Palm Beach, Florida. The results provided continuous *in situ* subsurface measurements, which were supplemented by surface ship measurements. Author

**N69-37234#** Pisa Univ. (Italy). Faculty of Engineering.
**DEFLECTION COMPONENTS IN THE MERIDAN AND PRIME VERTICAL THAT ALTER THE VERTICAL DUE TO THE PRESENCE OF TOPOGRAPHIC MASSES SURROUNDING THE STATION [COMPONENTI IN MERIDIANO E NEL PRIMO VERTICALE DELLA DEFLESSIONE CHE SUBISCE LA VERTICALE A CAUSA DELLA PRESENZA DELLE MASSE TOPOGRAFICHE CIRCONVICINE ALLA STAZIONE]**
Silvio Ballarin 1968 6 p In ITALIAN *Its* Ser. 25, No. 1220
(Publ-81) Avail: CFSTI

The deflection components in the meridien and the prime vertical are determined for a station, when the terrain profile

around the station is compared to that of a plane surface. Numerical solutions for these two components are presented for a particular station with the topographic influences limited to a 88 m distance from the station. The results are tabulated by height versus deflections. Transl. by F.O.S.

N69-37255*# Lockheed Missiles and Space Co., Huntsville, Ala. Huntsville Research and Engineering Center.
**A PRELIMINARY UPPER ATMOSPHERIC DENSITY MODEL DERIVED FROM SATELLITE DRAG DENSITY DATA Final Report**
J. H. Butler Aug. 1969 61 p refs
(Contract NAS8-30513)
(NASA-CR-61298; HREC-0513-1; D149120) Avail: CFSTI CSCL 04A

The object of this study was to develop a preliminary statistical model to better represent the atmospheric density fluctuations in the 170- to 360-kilometer altitude range. Satellite drag-determined densities versus exospheric temperatures were plotted for 10-kilometer altitude increments between 170 and 360 kilometers. Best-fit regression equations for each altitude available were generated. Results of first- through fifth-order fits indicated no appreciable loss in accuracy would result from using a first-order fit. The regression constants were extrapolated down to 100 kilometers to obtain equations for the density at the lower altitudes. The density at 90 kilometers was assumed constant. The resulting linear model was compared with the original Jacchia model in predicting mass density values and also in predicting the lifetimes of various satellites that have decayed. The model was also compared with two other existing density models. Results indicate the linear model to be a better mass density predictor than other models considered and at least comparable to the other models with respect to lifetime predictions. Author

N69-37257# Joint Publications Research Service, Washington, D.C.
**IMPROVEMENT OF EXISTING AND CREATION OF NEW INSTRUMENTS FOR SEISMIC STATIONS**
Ye. S. Borisevich et al 9 Sep. 1969 14 p refs Transl. into ENGLISH from the Publ. "Apparatura i Metodika Seysmometricheskikh Nabludeniy" Moscow, Nauka, 1966 p 3-15
(JPRS-48774) Avail: CFSTI

Equipment in use at seismic stations in the U.S.S.R. is critically evaluated, and steps to improve the existing equipment or to design new equipment are proposed. Operation, sensitivity, and accuracy of the equipment are discussed. In addition to general and auxiliary equipment, the review covers long-period seismographs, high-sensitivity instruments, semiautomatic recorders, galvanometers, seismometers for recording strong earthquakes, and timing instruments. K.W.

N69-37310# Northeastern Univ., Boston, Mass.
**RESEARCH AND INSTRUMENTATION FOR THE STUDY OF AIRGLOW AND AURORA PHENOMA Final Report, 1 Mar. 1966 - 31 Dec. 1969**
Louis J. Nardone 30 Apr. 1969 64 p refs
(Contract AF 19(628)-5731)
(AD-689175; AFCRL-69-0186) Avail: CFSTI CSCL 4/1

Summary descriptions are presented of various studies and programs which were conducted on airglow and aurora phenomena, in conjunction with related events, in support of the upper-atmosphere research program. Studies involving oxygen red-line emission, rocket measurements of sodium dayglow, upper atmospheric temperature measurements from the N2 + first negative band system and an observed red arc which were in the final phases of study, are presented either in an abstracted form or in preliminary rough-draft form prior to publication. Programs in progress but not completed are briefly described. A general description of various types of instrumentation for making optical studies of the light in the atmosphere is given. The presentation offers information useful in the design of the instruments rather than detailed particulars of any one design. Author (TAB)

N69-37312# Oslo Univ. (Norway). Inst. of Geophysics.
**A SIMPLIFIED TIME DEPENDENT OXYGEN-HYDROGEN ATMOSPHERE MODEL WITH VERTICAL EDDY DIFFUSION Final Report, Jul. 1967 - Sep. 1968**
Eigil Hesstvedt Mar. 1969 14 p ref
(Contract DAJA37-67-C-0848)
(AD-688952) Avail: CFSTI CSCL 4/1

A time dependent oxygen-hydrogen atmosphere model with constant (average) values for the dissociation rates is computed. For atomic oxygen a peak value of 7x10 to the 11th power is obtained for the number density at 85 km. Below this level water vapor and molecular hydrogen are the most important hydrogen components. In spite of the limitations caused by the unrealistic discontinuities in the dissociation at sunrise, the model gives some qualitative information about the time variation of OH*-emission after sunrise and after sunset. Author (TAB)

N69-37378*# Volt Information Sciences, Inc., Washington, D.C.
**ESTIMATES OF BOUNDARY LAYER PARAMETERS IN PLANETARY ATMOSPHERES OF THE TERRESTRIAL GROUP**
G. S. Golitsyn Greenbelt, Md. NASA Goddard Space Flight Center 26 Sep. 1969 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Atm. i Okeana. (Moscow), v. 5, no. 8, 1969 p 775-781
(Contract NAS5-12487)
(NASA-CR-105839; ST-PA-10671)

The similarity theory of atmospheric boundary layers is used to estimate the form of vertical profiles of average wind velocity and potential temperature under day and nighttime conditions. The boundary layers in the atmospheres of Mars and Venus and in the hypothetical atmosphere of Mercury are examined in detail. Sharp temperature drops are characteristic of Mars within the bounds of a few tens of meters, attaining several tens of degrees, which is caused by the low density of its atmosphere. For Venus, owing to very high atmospheric density, the stratification is close to neutral; i.e., the temperature profile is close to the adiabatic one. Owing to high winds, the stratification on Mercury must also be close to neutral with respect to the wind (the profile being close to the logarithmic), but because of low density, such temperature drops may be very great. Author

N69-37386# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
**INTERPRETATION OF VLF MAGNETIC FIELD MEASUREMENTS IN THE MAGNETOSPHERE [INTERPRETATION DE MESURES DE CHAMP MAGNETIQUE T.B.F. DANS LA MAGNETOSPHERE]**
Rejean Grard [1969] 6 p refs In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969
Avail: CFSTI

Results are presented of measurements made on board the FR-1 satellite. This satellite has been designed to study irregularities of the ionospheric electron distribution density and to investigate VLF electromagnetic wave propagation. ESRO

N69-37421# Institut Royal Meteorologique de Belgique, Brussels.
**GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Feb. 1969 [OBSERVATIONS GEOPHYSIQUES]**
Nov. 1969 37 p In FRENCH and DUTCH
Avail: CFSTI

Results of observations and measurements carried out at Dourbes (Belgium) in February 1969 are presented. They concern geomagnetism and geomagnetic pulsations, radioactivity of the atmosphere, ionospheric wave reflection, seismology, cosmic radiation and atmospheric electrical potential. Author (ESRO)

N69-37427# Akademiya Nauk URSR, Kiev.
GEOPHYSICAL COMMUNICATIONS, ISSUE 25
1968 85 p refs In RUSSIAN; ENGLISH summaries
Avail: CFSTI

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1. NATURE OF SEISMIC INTERFACES WITHIN THE EARTH'S CRUST V. B. Sollogub p 5-17 refs (See N69-37428 22-13)

2. ORIGINATION AND DEVELOPMENT OF EARTH'S CRUST AND ROLE OF RADIOACTIVITY IN CRUSTAL PROCESSES Yu. G. Gerasimov p 18-24 refs (See N69-37429 22-13)

3. RELATION BETWEEN HEAT FLOW AND ABYSSAL PROCESSES R. I. Kutas p 25-30 refs (See N69-37430 22-13)

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5. RESULTS OF CORRELATION REFRACTION INVESTIGATIONS OF THE DNIEPER-DON DEPRESSION STRUCTURAL FEATURES ALONG THE BLIZNETSY-SHEVCHENKOVO LINE T. V. Smelyanskaya p 47-55 refs (See N69-37432 22-13)

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7. MECHANISM OF FORMATION OF PLATFORM-TYPE SALT STRUCTURES V. G. Guterman p 61-81 refs (See N69-37434 22-13)

N69-37428# Akademiya Nauk URSR, Kiev.
**NATURE OF SEISMIC INTERFACES WITHIN THE EARTH'S CRUST**
V. B. Sollogub *In its* Geophys. Commun., Issue 25 1968 p 5-17 refs In RUSSIAN; ENGLISH summary (See N69-37427 22-13)
Avail: CFSTI

Three main seismic interfaces are distinguished by means of deep seismic soundings of the earth's crust: the first interface with a boundary velocity ($V_b$) equal to 5.8 to 6.2 km/sec (the crystalline basement surface), the second with $V_b$=6.8 to 7.2 km/sec (the Conrad surface) and the third with $V_b$=7.8 to 8.2 km/sec (the Mohorovicic surface). The layer between the basement surface and the interface with $V_b$=6.8 to 7.2 km/sec is called granitic; the layer between the seismic interface with $V_b$=6.8 to 7.2 km/sec and the Mohorovicic discontinuity is called basaltic. To determine the nature of the seismic interfaces within the earth's crust, the regularities of thickness variation of the main layers and their interrelation along several DSS profiles were analyzed, notably: the Black Sea-Voronezh Massif, Black Sea-Caspian Sea across the Urals, Pannonian Massif, Alps, etc. Author

N69-37429# Akademiya Nauk URSR, Kiev.
**ORIGINATION AND DEVELOPMENT OF EARTH'S CRUST AND ROLE OF RADIOACTIVITY IN CRUSTAL PROCESSES**
Yu. G. Gerasimov *In its* Geophys. Commun., Issue 25 1968 p 18-24 refs In RUSSIAN; ENGLISH summary (See N69-37427 22-13)
Avail: CFSTI

The geological process of heating of the earth began prior to its formation of a protoplanetary cloud. The processes of radioactive decay contributed the greatest percentage of heat. Primary irregularities of distribution of radioactive elements caused more intensive heating in individual centers which gradually shifted together with general heat outflow towards the permanently cooling earth's surface. Due to zonal melting the mantle substance was retained in the lower zones of foci, while in the frontal zones basalts and volatile components were melted out. Basalt magmas, waters, and gases penetrated onto the surface along primary fractures which resulted from the collapse and subsidence of a heavier nondifferentiated roof into the zone of basalt melting. Primary seas originated in subsidence zones and primary hills: in zones of stable volcanism, which in its turn caused isostatic movements. Radioactive elements at all stages of the earth's development were concentrated in upper strata of the crust, reflecting geochemical and tectonic conditions of rock formation. Author

N69-37430# Akademiya Nauk URSR, Kiev.
**RELATION BETWEEN HEAT FLOW AND ABYSSAL PROCESSES**
R. I. Kutas *In its* Geophys. Commun., Issue 25 1968 p 25-30 refs In RUSSIAN; ENGLISH summary (See N69-37427 22-13)
Avail: CFSTI

The thermal field nature undergoes considerable changes in connection with the peculiarities of geological structure of the area. The value of heat flow from the earth's interior varies from $(3 \div 4) \cdot 10^{-2}$ to $(10 \text{ to } 12) \cdot 10^{-2}$ watt/m$^2$. Zonas of elevated heat flow usually coincide with tectonically active areas. To explain the higher intensity of the heat flow it is necessary to suggest the existence in the lower crustal portion or in the upper mantle of additional sources of heat or its intense efflux from the earth's interior due to changes in the heat-transfer conditions. Analysis of the factual data and theoretical calculations show that the increase in heat flow cannot be explained in terms of a higher content of radioactive elements. A certain increase in heat flow may be associated with physical transformations of the material at the boundary between the earth's crust and upper mantle, accompanied by heat release. It is, however, unlikely that the heat released is sufficient to account for such intensive heat-flow anomalies on the surface of the earth. The most adequate explanation for the origination of heat-flow anomalies should involve the abyssal processes accompanied by heat release and evacuation of the material onto the surface. Author

N69-37431# Akademiya Nauk URSR, Kiev.
**DEEP CRUSTAL STRUCTURE IN THE AREA OF KOROSTEN PLUTONIC ROCKS ACCORDING TO SEISMIC DATA**
V. B. Sollogub, L. T. Kalyuzhnaya, and A. V. Chekunov *In its* Geophys. Commun., Issue 25 1968 p 31-46 refs In RUSSIAN; ENGLISH summary (See N69-37427 22-13)
Avail: CFSTI

Seismic investigations by the refraction technique as well as by deep spot soundings have been carried out in the area of the Korosten pluton. In the upper consolidated crust at a depth range down to 12 to 15 km, several seismic discontinuities have been identified having high velocities of elastic wave propagation (6.8 to 7.2 km/sec). Two large dislocations with breaks in continuity are distinguished. The most significant one is confined to an area separating the Volyn and Chepovichi masses of the gabbro-labradorites. The second dislocation bounds the Volyn massif on the south and southwest. Both faults have a northeastern dip, the first one being more steep, the second rather gentle. The second fault may well be an apophysis of the first one, which separates the Volyn and Chepovichi masses and contacts with the second fault at depth. Author

N69-37432# Akademiya Nauk URSR, Kiev.
**RESULTS OF CORRELATION REFRACTION INVESTIGATIONS OF THE DNIEPER-DON DEPRESSION STRUCTURAL FEATURES ALONG THE BLIZNETSY-SHEVCHENKOVO LINE**
T. V. Smelyanskaya *In its* Geophys. Commun., Issue 25 1968 p 47-55 refs In RUSSIAN; ENGLISH summary (See N69-37427 22-13)
Avail: CFSTI

Methodological and geological results are considered for a correlation refraction study of the Dnieper-Don depression

structure in the link zone with the Don Basin, where the depth to the precambrian crystalline basement surface exceeds 10 km. A description is given of the wave field recorded along the Bliznetsy – Shevchenkovo line by the correlation refraction method, and the peculiarities of correlating the waves from deep horizons within the sedimentary complex and from the basement surface are pointed out. The observed wave field is characterized by the following features: (1) presence of intensive noise with the axes of synchronous phases parallel to those of the first wave, the amplitudes of useful waves being comparable with those of noise, the form of the recording being rather involved; (2) close values of apparent velocities of all useful waves, those from the basement surface included; (3) and penetration of a wave from one sedimentary horizon into another. Penetration of a wave from the basement surface into a horizon within the sedimentary complex does not cause any variations in the dynamic properties of the waves. Author

**N69-37433#** Akademiya Nauk URSR, Kiev.
**APPLICATION OF THE SEISMIC CONTROLLED DIRECTIONAL RECEPTION TECHNIQUE IN DEEP CRUSTAL INVESTIGATIONS**
F. A. Leshchuk *In its* Geophys. Commun., Issue 25 1968 p 56–60 refs In RUSSIAN; ENGLISH summary (See N69-37427 22-13)
Avail: CFSTI

Results of application of a laboratory version of the controlled directional reception (CDR) method for processing deep seismic sounding data are presented. Sub-critical reflections are used. A seismic cross-section of the basaltic crustal portion down to 30 km is constructed, and a great number of interfaces are distinguished. The rough character of the interfaces is pointed out. Tectonic dislocations are distinctly traced. An important role in their origination pertains to diffracted waves. The CDR cross section is shown to be fairly consistent with the data obtained using other methods (correlation refraction and gravity). Author

**N69-37434#** Akademiya Nauk URSR, Kiev.
**MECHANISM OF FORMATION OF PLATFORM-TYPE SALT STRUCTURES**
V. G. Guterman *In its* Geophys. Commun., Issue 25 1968 p 61–81 refs In RUSSIAN; ENGLISH summary (See N69-37427 22-13)
Avail: CFSTI

A mechanism of formation of salt structures is discussed in terms of a supposition that the rocks overlying the salt possess elastico-brittle properties and the salt proper possesses elastico-viscous properties. Solutions are presented for problems dealing with the strained state of the sedimentary series in the first moment of application of external stress, in which case the elasticity theory equations are valid. Zones of potential fractures are established for various modes of straining of an elastic strip modeling the sedimentary complex. It is shown that the zones of faults extending to maximum depths do not coincide with zones of maximum faulting. The former zones are distributed on the margins of the area to which normal bending stress is applied, the latter ones are directly above that area, close to the free surface. The mechanism of formation of salt structures is described on the basis of the regularities of the primary stress field and qualitative analysis of the behavior in such conditions of the above-salt rocks and the salt proper, possessing different mechanical properties. Author

**N69-37481#** Paris Univ. (France). Institut de Physique du Globe.
**LIMITS IMPOSED BY NATURAL MAGNETIC NOISE ON THE MEASUREMENT OF SMALL FIELDS [LIMITES IMPOSEES PAR LE BRUIT MAGNETIQUE NATUREL DANS LA MESURE DES CHAMPS FAIBLES]**
E. Salzer [1969] 14 p In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969
Avail: CFSTI

The effect of random or periodical magnetic noise such as continuous or irregular magnetic pulsations on the measurement of small magnetic fields, and in particular of the geomagnetic field is discussed taking into account the measurement duration versus the rate of the pulsations. Magnetic measurements underwater are discussed in this respect. ESRO

**N69-37488*#** Institut Royal Meteorologique de Belgique, Brussels.
**IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Mar. 1969 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE]**
Mar. 1969 28 p In FRENCH and DUTCH
Avail: CFSTI

Ionospheric and cosmic ray data derived from observations made at Dourbes (Belgium) in March 1969 are given. ESRO

**N69-37471#** Institut Royal Meteorologique de Belgique, Brussels.
**GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Mar. 1969 [OBSERVATIONS GEOPHYSIQUES]**
Mar. 1969 41 p In FRENCH and DUTCH
Avail: CFSTI

Data are given from the geophysical observatories in Belgium related to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity and cosmic rays for March 1969. ESRO

**N69-37489#** Akademiya Nauk URSR, Kiev.
**GEOPHYSICAL COMMUNICATIONS, ISSUE 28**
1968 100 p refs In RUSSIAN; ENGLISH summaries
Avail: CFSTI

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2. CRIMEAN EARTHQUAKES BETWEEN 1800 AND 1967 R. N. Morozova and N. V. Shebalin (Acad. of Sci. (USSR), Moscow) p 13–41 refs (See N69-37491 22-13)

3. INTERRELATION BETWEEN FRACTURES OF THE RUSSIAN PLATFORM AND STRUCTURE OF THE SEDIMENTARY COMPLEX L. N. Rozanov (All-Union Geol. Res. Inst.) p 42–47 refs (See N69-37492 22-13)

4. VELOCITIES AND SEISMIC WAVE FIELD IN CRIMEAN PROSPECTING BOREHOLES V. I. Merkulov, A. N. Amirov, N. K. Kivshik, V. M. Karasik, and S. I. Didenko p 48–51 refs (See N69-37493 22-13)

5. INTENSITY OF SUM MULTIPLE WAVE REFLECTION IN LAYERED GEOLOGICAL MEDIA E. K. Losovsky p 52–62 refs (See N69-37494 22-13)

6. RECORDING S-WAVES FROM CRUSTAL INTERFACES N. I. Pavlenkova p 63–71 refs (See N69-37495 22-13)

7. TECTOGENESIS AND EVOLUTION OF THE EARTH'S CRUST A. V. Chekunov p 72–88 refs (See N69-37496 22-13)

**N69-37490#** Academy of Sciences (USSR), Moscow. Inst. of the Earth's Magnetism, Ionosphere and Radio Wave Propagation.
**MANIFESTATION OF FRACTURE ZONES WITHIN EARTH'S CRUST IN MAGNETIC FIELD**
T. N. Simonenko *In* Akad. Nauk URSR Geophys. Commun., Issue 26 1968 p 5–12 refs In RUSSIAN; ENGLISH summary (See N69-37489 22-13)
Avail: CFSTI

Manifestation of regional crustal fractures in the magnetic field is discussed. A scheme of magnetic field elements on the territory of the USSR is given. The elements may be associated with regional crustal fracture zones. Variety in spatial distribution of magnetic anomalies is shown to be indicative of a complex block

structure of the earth's crust on the territory of the Soviet Union.
Author

N69-37491# Academy of Sciences (USSR), Moscow.
**CRIMEAN EARTHQUAKES BETWEEN 1800 AND 1967**
R. N. Morozova and N. V. Shebalin *In* Akad. Nauk URSR Geophys. Commun., Issue 26 1968 p 13–41 refs In RUSSIAN; ENGLISH summary (See N69-37489 22-13)
Avail: CFSTI

Macroseismic and instrumental catalogs of Crimean earthquakes were revised, and the data were studied jointly, based on a correlation between magnitude, focal depth, and seismic intensity. A critical catalogue of Crimean earthquakes was compiled which contains representative data for shock with M > 4 1/2 from the year 1815 and with M > 4 from 1878 to the present. It includes the data for 173 shocks. The magnitude is estimated for all 164 authentic Crimean shocks, and the focal depth is estimated for 161 of these.
Author

N69-37492# All-Union Geological Research Inst., Leningrad (USSR).
**INTERRELATION BETWEEN FRACTURES OF THE RUSSIAN PLATFORM AND STRUCTURE OF THE SEDIMENTARY COMPLEX**
L. N. Rozanov *In* Akad. Nauk URSR Geophys. Commun., Issue 26 1968 p 42–47 refs In RUSSIAN; ENGLISH summary (See N69-37489 22-13)
Avail: CFSTI

A great number of local positive structures of the Russian Platform complex are confined to flexures distributed over the fractures in the crystalline basement. Not all the fractures in the basement, however, are associated with local structures. They appear over the blocks which had undergone upward movements, and are not observed along flexures on the margins of large zones of subsidence. Distribution of local structures are explained in terms of their formation resulting from the secondary redistribution of thicknesses of the sedimentary complex plastic rocks, effected by the pressure caused by the uplifting basement blocks. It is recommended that tectonic elements, which had undergone upward movements resulting from their inversion, be isolated and traced.
Author

N69-37493# Akademiya Nauk URSR, Kiev.
**VELOCITIES AND SEISMIC WAVE FIELD IN CRIMEAN PROSPECTING BOREHOLES**
V. I. Merkulov, A. N. Amirov, N. K. Kivshik, V. M. Karasik, and S. I. Didenko *In its* Geophys. Commun., Issue 26 1968 p 48–51 refs In RUSSIAN; ENGLISH summary (See N69-37489 22-13)
Avail: CFSTI

Results of seismic well logging in the Crimea are presented. A brief description of the equipment for borehole observations is given. Data on elastic properties of the complexes are tabulated. A short discussion of the seismic wave field in different Crimean areas is given. Conclusions are drawn as to the results of the investigations.
Author

N69-37494# Akademiya Nauk URSR, Kiev.
**INTENSITY OF SUM MULTIPLE WAVE REFLECTION IN LAYERED GEOLOGICAL MEDIA**
E. K. Lossovsky *In its* Geophys. Commun., Issue 26 1968 p 52–62 refs In RUSSIAN; ENGLISH summary (See N69-37489 22-13)
Avail: CFSTI

Intensities of sum multiple reflection originating in idealized models of complex geological series of 200 to 500 layers are studied. The stability of the estimations is discussed based on concrete examples. The noise level created by sum multiple waves in an area of the Crimean Plain is calculated and analyzed. The models of multilayered media show that the amplitudes of sum multiple reflections generally do not exceed 0.6 to 0.8 of the amplitudes of primary reflections arriving simultaneously in the interval $t_0 = (0-2)$ sec. Amplitudes of the sum multiple noise increase sharply after the strong primaries. Calculations were carried out on a digital computer.
Author

N69-37495# Akademiya Nauk URSR, Kiev.
**RECORDING S-WAVES FROM CRUSTAL INTERFACES**
N. I. Pavlenkova *In its* Geophys. Commun., Issue 26 1968 p 63–71 refs In RUSSIAN; ENGLISH summary (See N69-37489 22-13)
Avail: CFSTI

Shear waves of different types as well as converted waves from crustal interfaces were recorded in the course of experimental studies carried out by means of deep seismic sounding. High intensity shear waves originated at the basement (sediments boundary in the area of the Ukrainian crystalline shield) and may therefore be used for studying the whole crust. Of all the waves associated with crustal interfaces, shear waves reflected from the M discontinuity are identified with the highest degree of reliability. Concerning converted waves, only those with conversion at the basement surface are distinguished, provided that the basement is overlain by young unconsolidated sediments. The ratio of shear and longitudinal wave velocities in crustal layers is determined to be 1.68 to 1.70.
Author

N69-37496# Akademiya Nauk URSR, Kiev.
**TECTOGENESIS AND EVOLUTION OF THE EARTH'S CRUST**
A. V. Chekunov *In its* Geophys. Commun., Issue 26 1968 p 72–86 refs In RUSSIAN; ENGLISH summary (See N69-37489 22-13)
Avail: CFSTI

Analysis of the materials of deep seismic soundings in the southern European USSR and neighboring countries was accomplished in the light of geological, petrological, and physical evidence. It is shown that the role of phase or metamorphous displacement (gliding) of crustal interfaces along with the Moho discontinuity in the process of formation of geological structures is somewhat exaggerated. The effect of horizontal stresses and movements is essential. The source of the horizontal stresses within the earth's crust in the formation of the most typical structures (Dnieper-Don and Hungarian depressions, Carpathians, and Carpathian foredeep) might be the convection currents in the subcrustal substratum. The material of the earth's crust during the horizontal movements underwent laminar differentiated plastic flowing. With the geologically prolonged effect of the loads, over hundreds of millions of years, the material of the earth's curst was deformed in accordance with the laws of creep.
Author

N69-37498# Institut Royal Meteorologique de Belgique, Brussels.
**ATMOSPHERIC MOISTURE DROPS [LES GOUTTES ATMOSPHERIQUES]**
L. Dufour 1968 77 p refs In FRENCH *Its* Publ. Ser. B, No. 54
Avail: CFSTI

The physical properties of raindrops are reviewed and discussed and their stability as functions of drop radius and atmospheric moisture content is analyzed. Methods for measuring raindrop size etc. are also described and discussed.
Author (ESRO)

N69-37504# Institut Royal Meteorologique de Belgique, Brussels.
**IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Apr. 1969 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE]**
Apr. 1969 28 p In FRENCH and DUTCH
Avail: CFSTI

Ionospheric and cosmic ray data derived from observations made at Dourbes (Belgium) in April 1969 are given.
ESRO

N69-37513# Paris Univ. (France). Inst. de Physique du Globe.
**MAGNETOMETEOROLOGY: DISCUSSION OF ATMOSPHERIC EFFECT ON THE GEOMAGNETIC FIELD AND ITS CONSEQUENCES [MAGNETO-METEOROLOGIE: DISCUSSION D'UN EFFET ATMOSPHERIQUE SUR LE CHAMP MAGNETIQUE TERRESTRE ET DE SES CONSEQUENCES]**
P. Bernard [1969] 5 p In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969
Avail: CFSTI

Periodic decennial perturbations of the geomagnetic field have been recorded. A hypothesis is presented to explain these variations based on the variation of the ionization rate in the upper atmosphere. Zonal winds would carry the positive ions away whereas the movement of negative electrons would be trapped in a direction perpendicular to the magnetic lines of force. This hypothesis is used to explain the reversal of the geomagnetic field and the absence of magnetic fields on other planets. ESRO

N69-37540# Hawaii Inst. of Geophysics, Honolulu.
**EDDIES IN HAWAIIAN WATERS**
William Charles Patzert Apr. 1968 136 p refs
(Contract Nonr-3748(06))
(AD-689099; HIG-69-8) Avail: CFSTI CSCL 8/3

Oceanographic observations near the Hawaiian Islands demonstrate that ocean circulation is extremely variable and is dominated by eddies with diameters ranging from 50 to 150 kilometers. The data from 20 cruises that describe these eddies have been analyzed. Most of the eddies are cyclonic, and have been observed during all seasons. Observations show that the flow in them is nearly geostrophic and volume transports can be as large as 8 million cu m/sec. Although surface flow around them can be in excess of 100 cm/sec, the eddies are relatively shallow in depth and most of the horizontal flow is concentrated in the upper 150 m, above the 20C isothermal surface. Calculations show that the eddies are not generated by the large-scale flow through the Hawaiian Islands--in the sense of a Karman vortex stream behind an obstacle. Energy calculations indicate rather that the eddies are driven by strong, local winds blowing through the restricted passage between the islands of Maui and Hawaii. The calculations show that the eddies have a formation time of between 2 and 6 weeks, a value consistent with observations. Author (TAB)

N69-37578*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SUMMARY OF PARTICLE POPULATIONS IN THE MAGNETOSPHERE**
James I. Vette Sep. 1968 28 p refs
(NASA-TM-X-63673; X-601-69-373) Avail: CFSTI CSCL 04A

The main emphasis in this summary description is on the time averaged behavior rather than the detailed dynamical changes which occur. The magnetosphere is discussed as three separate regions: plasma sheet, pseudo-trapping and stable trapping. The plasma sheet extends across the tail of the magnetosphere and contains electrons and protons with an average energy of 0.6 keV and 5 keV respectively. The average outer boundary of the pseudo-trapping region is around 12 $R_E$. This region is spatially coincident with the auroral zone and represents an acceleration region where electrons are increased in energy to ~100 keV. In an average radial profile, particle fluxes in this region are seen only as a continuation of the radiation belts; however the shorter term time variations seen on individual satellite passes are quite distinctive. The low altitude boundary mapped on the equatorial plane by using the average magnetic field configuration presented by Fairfield agrees well with the boundary obtained in the equatorial plane except in the dawn-midnight quadrant. This difference may lead to an explanation of the dawn-dusk electron asymmetry seen at 17-18 $R_E$. The stable trapping boundary exists at 8 $R_E$. Author

N69-37582*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A PRELIMINARY SURVEY OF THE DISTRIBUTION OF MICROPULSATIONS IN THE MAGNETOSPHERE FROM OGO'S 3 AND 5**
J. P. Heppner, E. G. Ledley, T. L. Skillman, and M. Sugiura Sep. 1968 31 p refs Presented at IAGA Gen. Assembly, Madrid, Sep., 1969 Submitted for publication
(NASA-TM-X-63882; X-612-69-429) Avail: CFSTI CSCL 04A

Magnetic field data from the OGO-3 and 5 satellites is being systematically scanned to determine the magnetospheric distribution of micropulsations in 7 bands (periods: 0.8 to 2$^s$, 2-5$^s$, 5-10$^s$, 10-25$^s$, 25-45$^s$, 45-120$^s$, and 120-120$^s$) and incoherent irregularities in two categories (time constants: $T < 8^s$ and $8^s < T < 45^s$). The characteristics and distribution of Pc-3 waves (10-45$^s$) with a broad dayside maximum roughly independent of distance agrees exceptionally well with well known Pc-3 properties at the earth's surface. Pc-4 (45-150$^s$) distributions are similar to Pc-3 but some difference appears in detail. Waves with Pc-2 periods (5-10$^s$) are statistically distributed in close coincidence with the distributions of waves with Pc-1 periods (0.2-5$^s$). The magnetospheric distribution of periods $0.8^s$ to $10^4$ is however completely different than that for periods $10^4$-$120^s$. The percentage of time signals appear in the $0.8$-$10^s$ range has a pronounced maximum within the magnetosphere near the magnetopause and the 6$^h$ LT meridian with high percentages extending tailward near the magnetopause. Author

N69-37600# Fuerstenfeldbruck Observatory (West Germany).
**SEISMOLOGY REPORT OF THE STATION FUERSTENFELDBRUCK FOR 1966 AND OF THE STATION HOF FOR THE YEARS 1966-1968 [SEISMOLOGISCHER BERICHT DER ERDBEBENWARTE FUERSTENFELDBRUCK FUER DAS JAHRE 1966 UND SEISMISCHER BERICHT DER ERDBEBENWARTE HOF FUER DIE JAHRE 1966-1968]**
1968 165 p In GERMAN *Its* Ser. C, No. 3
Avail: CFSTI

The Fuerstenfeldbruck station is equipped with three-component long-periodic seismographs and galvenometers. At the Hof station, a small, 200-kg astatic horizontal pendulum and a small, 80-kg vertical seismograph are used. Data of all registered tremors are presented in tables, giving time/date of recording, phase and component, duration, amplitude, direction, source time, source coordinates, depth, location of epicenter, magnitude, and azimuth. Location, instrumentation, and registration methods of the two stations are described. Transl. by K.W.

N69-37607# Radio and Space Research Station, Slough (England).
**ON EXPLAINING THE BEHAVIOUR OF THE IONOSPHERIC F-REGION**
H. Rishbeth 1968 53 p refs Submitted for publication
Avail: CFSTI

A basic physical theory of the F region behavior and some of the physical processes which influence the region are outlined. Possible explanations are discussed for the presence of the gross quantity of ionization in the region; the flux of solar radiation is considered. Data include $F_2$ information on daily, seasonal, and annual variations of peak electron density, peak height, night time F layer, and the equatorial $F_2$ layer. Brief comments are made of $F_2$ layer during storms at high latitudes, conjugate point effects, and the existence of negative ions in the F region. Author

N69-37620# Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Service.
**GEOMAGNETIC PULSATIONS AND AURORAL ACTIVITY [PULSAZIONI GEOMAGNETICHE ED ATTIVITA AURORALE]**
M. Boscolosco et al 1968 10 p refs Transl. into ENGLISH from Geofis. Meteorol. (Genoa), v. 16, no. 1/2, 1967 p 1-3
*Its* Rel. 728

Avail: CFSTI

Using the records of the geomagnetic pulsations gathered at Roburent (Prov. Cuneo) from June 1965 to November 1966, it is demonstrated that the 1389 cases of pse (pulsation single effect) are falling with the frequency of nearly 90% during periods of auroral activity, as defined by the riometer records taken simultaneously at Great Whale River (Canada). The pse, as originated by the interaction of intense solar corpuscular emissions, is therefore a phenomenon belonging also to the middle latitudes. Further, adopting a simplified model of the magnetosphere, a numerical approach shows that the pse observed at Roburent is generally generated at distances between 12 and 27 earth-radii, i.e., chiefly on the night-side of the earth. Author

**N69-37623#** Institut Fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**CARTOGRAPHIC AND GEODETIC SURVEYING REPORTS. SERIES 1: GERMAN CONTRIBUTIONS AND INFORMATION. NO. 41: STUDY OF THE AUTOMATION OF CARTOGRAPHIC PROCESSING OF MAPS [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: DEUTSCHE BEITRAEGE UND INFORMATIONEN. HEFT 41: UNTERSUCHUNG ZUR AUTOMATION DER KARTOGRAPHISCHEN BEARBEITUNG VON LANDKARTEN]**
Fred Christ 1969 114 p refs In GERMAN
Avail: CFSTI

Aims, tasks, and present possibilities for automation of cartographic processes are examined. The study of aims is directed toward rationalization of cartographic work, numerical processes of analog maps, updating of maps, objectivity in map design, and improvement of working conditions for persons employed in cartography. The tasks involved in achieving these aims are considered, including automation of manual production and processing steps, partial automation of design, automation of drafting symbols and codes, cartographic data banks, and training of personnel. The review of present possibilities covers digitalization of maps and map design, drafting machines, automated engraving and photocopying, computer processing of cartographic data, and computer storage of cartographic names. Photographs and diagrams of hardware and software are presented, and an extensive bibliography is included. Transl. by K.W.

**N69-37636#** Paris Univ. (France). Laboratoire de Physique de l'Atmosphere.
**IONOSPHERIC RESEARCHES USING SATELLITES Final Scientific Report, 1 Apr. 1968 - 31 Mar. 1969**
Vassy J. Etienne Apr. 1969 41 p refs
(Contract F61052-68-C-0055)
(AD-689200; AFCRL-69-0267) Avail: CFSTI CSCL 4/1

With respect to the solar cycle, the variation of the total electron content (T.E.C.) at noon is not the same for the different seasons. Three parabolic relations are found, corresponding respectively to the winter, summer and equinoxes. Only two relations are found (one for summer and another for the equinoxes) when all diurnal maxima are considered, whatever be their time of occurence. A semi annual variation can be seen on the midday total electron content, the amplitude of which decreases when solar activity increases. There is a good correlation between this semi annual T.E.C. variation and the equivalent slab thickness variation. By studying the diurnal and seasonal variations of slab thickness and T.E.C. measurements, it is possible to deduce some ionospheric properties in function of the main geophysical parameters. It is not always possible to explain these different ionospheric properties in terms of recombinations governed by the local electronic temperature. It seems that the transport phenomena are more likely to give a valid explanation. Author (TAB)

**N69-37686*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**AURORAL AND POLAR CAP ELECTRIC FIELDS FROM BARIUM RELEASES**
Eugene M. Wescott, John D. Stolarik, and James P. Heppner Aug 1969 21 p refs Presented at the Summer Advan. Study Inst. on Earth's Particles and Fields, Santa Barbara, Calif., 4 - 15 Aug 1969
(NASA-TM-X-63679; X-612-69-411) Avail: CFSTI CSCL 04A

Barium vapor released from sounding rockets into the upper atmosphere partially ionized and produced a visible ion cloud for photographic tracking. Cloud drifts under the effects of electric and magnetic fields were measured by ground based magnetometers and a typical ionospheric current pattern for the polar cap and auroral zone disturbance was developed. Results showed that the ionospheric disturbance in the polar cap region contained an appreciable amount of a nonionospheric sunward directed vector component comparable in magnitude to the magnitude of the Hall current component. G.B.

**N69-37707*#** GCA Corp., Bedford, Mass. Technology Div.
**INVESTIGATION OF TEMPORAL VARIATION OF WINDS Final Report**
J. F. Bedinger and E. Constantinides Aug. 1969 69 p refs
(Contract NAS5-11572)
(NASA-CR-105919; GCA-TR-69-3-N) Avail: CFSTI CSCL 04A

The methods and results of two types of analysis of upper atmospheric wind data obtained from observations of vapor trails are discussed. The temporal variations of the winds were studied directly from data that were closely spaced in time and that extended over an interval of several hours. Then, the entire data sample was analyzed using statistical methods. Each of the analytical procedures revealed interesting characteristics of the winds. Author

**N69-37715#** Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
**OBSERVATIONS OF MOTION AT INTERMEDIATE AND LARGE SCALES IN A COASTAL PLAIN ESTUARY**
Glenn A. Cannon Mar. 1969 129 p refs
(Contract Nonr-4010(11))
(AD-689142; TR-52; REF-69-5) Avail: CFSTI CSCL 8/8

The immediate purpose of the proposed experiments was to obtain a set of simultaneous Eulerian measurements of horizontal velocities. The specific objective of this investigation was to determine, in the field, how representative a record obtained at one point was of a record obtained at another point as a function of the separation. Author (TAB)

**N69-37716#** Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
**CONSTRUCTION OF F/H MAPS AND COMPARISON OF MEASURED DEEP-SEA MOTIONS WITH THE F/H MAP FOR THE NORTH ATLANTIC OCEAN**
Douglas E. Moore Mar. 1969 71 p refs
(Contract Nonr-4010(11))
(AD-689141; TR-51; REF-69-4) Avail: CFSTI CSCL 8/3

Potential vorticity equations as derived by Welander are presented. These equations are compared with similar formulations used by Sverdrup and Stommel. Maps of the planetary vorticity divided by the depth of the ocean, f/H, are presented for the North Atlantic, and the South Atlantic Oceans. Current-meter and float record data has been collected, analyzed, and compared with the current directions suggested by the maps. The agreement between the vertically averaged current directions and the directions suggested by the North Atlantic f/H-map mildly supported the notion that the transport of a water column tends to follow lines of constant f/H. Author (TAB)

**N69-37733#** Danish Meteorological Inst., Charlottenlund.
**RUDE SKOV GEOPHYSICAL OBSERVATORY: MAGNETIC RESULTS 1966**
1969 35 p
Avail: CFSTI

Results of standard magnetic observations carried out at the Rude Skov Observatory in Denmark during 1966 are recorded.
ESRO

N69-37753# Utah Univ., Salt Lake City. Upper Air Research Lab.
**ROCKET TECHNIQUES FOR MEASUREMENT OF ATMOSPHERIC DENSITY Final Report, 1 Jun. 1967–31 Oct. 1968**
Clay D. Westlund, Obed C. Haycock, L. Carl Howlett, Russell L. Smith, J. Irvin et al Nov. 1968 62 p refs
(Contract F19628-67-C-0327)
(AD-689242; UU-68-11; AFCRL-68-0613) Avail: CFSTI CSCL 4/1

The report details operational systems which were designed to measure air density parameters above regions investigated by balloons and aircraft. The air density measurements under this contract have been investigated principally by falling sphere instrumentation. A transit-time, omnidirectional accelerometer has been used in a 7-inch sphere system. Research and development of two 10-inch sphere accelerometers has been conducted, and the proposals for the Utah light-shell accelerometer and the Utah triaxial bridge accelerometer are presented. A Rayleigh scattered light experiment was another system which was utilized under this contract to conduct measurements of air density parameters. The scattered light experiment utilized rocket-borne optical equipment to detect Rayleigh scattered light from a high intensity mercury arc lamp onboard the rocket. Author (TAB)

N69-37756# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
**THE DISTRIBUTION OF SOLAR ENERGY REFLECTED FROM THE EARTH BY SCATTERING ATMOSPHERE, 1 AUGUST–1 NOVEMBER 1968**
B. Larkin 30 Apr. 1969 49 p refs
(Contract F04701-68-C-0200)
(AD-689231; TR-0200(4306-01)-1; SAMSO-TR-69-160) Avail: CFSTI CSCL 4/1

By our using a computer to perform certain numerical integrations, a model for the distribution of earth reflected sunlight (albedo energy) has been developed. Unlike many treatments of this problem which assume that albedo energy is reflected from a diffuse surface, in this study it is scattered by an atmosphere. This atmosphere is assumed to be homogeneous and to scatter isotropically. By proper selection of the optical thickness, it was possible to develop a scattering model which was characterized by an average albedo of 0.34. Locally, however, the albedo was not constant. A comparison of the scattering model with satellite data, showed that the model followed the general trend of the data with regard to the limb-brightening effect. This trend is not followed by the diffuse reflector model. Because the scattering model is no more complex than the diffuse model, and because it does have some physical basis, it could be of value in the thermal design of low-flying satellites. Author (TAB)

N69-37758# McDonnell-Douglas Astronautics Co., Santa Monica, Calif. Space Sciences Dept.
**DISTRIBUTION OF MAGNETIC ACTIVITY IN HIGH LATITUDES**
V. M. Mishin et al Apr. 1969 14 p refs Transl. into ENGLISH from Russian report
(MDAC-63284) Avail: CFSTI

The latitude distribution of the mean level of magnetic activity is analyzed. This analysis reveals the existence of two semicircular zones of the maximum activity near $\phi = 63-65°$ and $\phi = 78°$ Author

N69-37762# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
**SURFACE MEASUREMENTS OF SNOW AND ICE FOR CORRELATION WITH AIRCRAFT AND SATELLITE OBSERVATIONS**
Michael A. Bilello May 1969 15 p refs
(AD-689449; CRREL-SR-127) Avail: CFSTI CSCL 8/12

The seasonal extent of the earth's snow and ice cover can easily be determined by aircraft and satellite reconnaissance. However, determination of the depth and physical properties of the snow cover and the thickness of ice on lakes, rivers and along coastlines by these remote sensors is in an early stage of development. Correlation of the remote sensing data with actual surface conditions could be accomplished through use of an existing network of snow and ice stations located throughout North America. This network, comprising over 100 stations, is maintained by U.S. Army Terrestial Sciences Center (USA TSC) in cooperation with other government agencies and accumulates the most extensive and reliable data for such correlation studies. Author (TAB)

N69-37763# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astro Physics Lab.
**A MULTI-WAVELENGTH LINE-OF-SIGHT EXPERIMENT FOR REMOTE ATMOSPHERIC SENSING**
C. I. Beard, W. T. Kreiss, and W. G Tank Nov. 1968 70 p refs
(AD-689474; D1-82-0778) Avail: CFSTI CSCL 4/1

This article describes a multi-wavelength program for exploring atmospheric inhomogeneities simultaneously with combined microwave and infrared techniques, each of which features particularly suited for such a study. The aim of the program is severalfold: (a) to investigate simultaneously the sensitivity of these new techniques to various kinds of atmospheric inhomogeneities so that the potentialities of these methods for remote observations can be assessed; (b) to study specific physical phenomena, both short and long term and (c) to acquire a better understanding of the electromagnetic scattering processes. Author (TAB)

N69-37782# Norwegian Defence Research Establishment, Kjeller.
**OBSERVATIONS AND STUDIES OF AURORAL IONIZATION PROCESSES**
Gunnar Skovli 12 Mar. 1969 10 p refs
(Contract F61052-68-C-0046)
(AD-689185; AFCRL-69-0206) Avail: CFSTI CSCL 4/1

The objective of the research programme is to study the properties of the auroral D-region in a quantitative manner. Author (TAB)

N69-37787# RAND Corp., Santa Monica, Calif.
**DISCUSSION: "NEW HORIZONS IN THE FIELD OF TIDAL HYDRAULICS"**
J. J. Leendertse Jun. 1969 10 p refs
(AD-688545; P-4106) Avail: CFSTI CSCL 8/8

The author gives a good review of the problems associated with improvements of tidal waterways. His conclusions about necessary additional research are very logically drawn from his presentation of the state of knowledge in various areas. However, this writer sees a different approach to determining research needs, which is the basis for this discussion. From this discussion it will be clear that new horizons in the field of tidal hydraulics will mean expanded application of techniques successfully used in other fields of engineering, science, and government, such as systems analyses, operations research, and digital simulation. TAB

N69-37797# Naval Postgraduate School, Monterey, Calif.
**TEMPERATURE AND DENSITY STRUCTURE OF WATER ALONG THE CALIFORNIA COAST**
Richard Warren Holly (M.S. Thesis) Dec. 1968 201 p refs
(AD-689723) Avail: CFSTI CSCL 8/10

A synoptic analysis of the temperature field off the California coast for the surface, 10-meter and 100-meter level is provided for the years 1958-1959. Data used are from CCOFI cruises.

These analyses are shown to be adequate for detecting probable upwelling areas. The areas of persistent upwelling are at 29 N, 31 N and 33 N adjacent to the California coast. There appears to be a preference for a steep gradient of the sea floor in these areas. The onset and decay of upwelling appears to depend on latitudinal position of the 11 C isotherm at 100 meters. Author (TAB)

N69-37834# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
GEOMETRY OF THE EARTH ELLIPSOID
V. N. Ganshin Apr. 1969 145 p refs Transl. into ENGLISH of the book "Geometriya Zemnogo Ellipsoida" Moscow, Nedra, 1967 p 1-115
(AD-689507; ACIC-TC-1473) Avail: CFSTI CSCL 8/5

The book develops consectively the relationships between elements of the ellipse, sphere, and spheroid needed for the solution of geodetic problems at distances up to 20,000 km., both by geodetic line and by normal section. In addition, relationships are established between the lengths and azimuths of certain curves on the spheroid which are of particular interest for geodesy. Author (TAB)

N69-37864# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
RESULTS OF STUDY OF THE FORM OF THE GEOIDAL SURFACE IN ANTARCTICA [REZULTATY ISSLEDOVANII FORMY POVERKHNOSTI GEOIDA V ANTARKTIDE]
A. I. Frolov Mar. 1969 26 p refs Transl. into ENGLISH from Morsk. Gravimetricheskie Issled. (Moscow), v. 3, 1967 p 99-112
(AD-689508; ACIC-TC-1487) Avail: CFSTI CSCL 8/7

Because of hydrological and geophysical investigations in Antarctica carried out by various countries, it is possible to present in the first approximation the structure of the sub-glacial relief and gravity field of considerable sections of the Antarctic continent and ocean. Author (TAB)

N69-37880# Deutscher Wetterdienst, Offenbach am Main (West Germany). Zentralamt.
RESULTS OF 1966 AEROLOGICAL OZONE SOUNDINGS AT THE HOHENPEISSENBERG METEOROLOGICAL OBSERVATORY Final Report (Part 1), Dec. 1966 - Dec. 1967
Walter Attmannspacher Dec. 1967 129 p refs
(Contract DAJA37-67-C-0317)
(AD-688963) Avail: CFSTI CSCL 4/1

The report contains vertical soundings of wind, temperature, pressure and ozone over Southern Germany. Soundings were made every two weeks as a continuation of the measurements started during the International Quiet Sun Years. Author (TAB)

N69-37919# Army Foreign Science and Technology Center, Washington, D.C.
PHOTOELECTRONIC COLOR SEPARATION BY SERVOMECHANISMS IN CARTOGRAPHY
N. K. Beresnev et al Mar. 1969 14 p Transl. into ENGLISH from Geodez. i Kartograf (Moscow), no. 1, 1968 p 61-67
(AD-689207; FSTC-HT-23-769-68) Avail: CFSTI CSCL 8/2

The proposed method for automatic color separation of the mapped elements on a map compilation is based on the use of the spectal sensitivity of the photoelectric unit of the photomultiplier tracking system and the use of colors with a definite reflection (emission) spectrum. There are two variants of this method, which can be called photoelectronic color separation. In the first variant the line elements on the map compilation are drafted in the ordinary inks, distinguishable in color, reflecting two of the three zones of the visible part of the spectrum: blue, green, red. This variant affords the possibility for three-color separation of the map compilation. Photoelectronic color separation has essential differences from reproduction color separation used in map production. In the photoelectronic method the desired color separation effect is obtained at once after introducing the tracking device into its tracking regime because the light flux reflected from the tracked line instantaneously causes photoemission. In the second variant of photoelectronic color separation, linear symbols are drafted on the map compilation in the luminescent inks used in three-color photomechanical color separation. The use of luminescent inks for finalizing map compilations has a number of advantages over ordinary inks. Author (TAB)

N69-37977# Akademiya Nauk URSR, Kiev.
GEOPHYSICAL COMMUNICATIONS, ISSUE 23
1968 122 p refs In RUSSIAN; ENGLISH summaries
Avail: CFSTI

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7. UTILIZATION OF SYNTHETIC SEISMOGRAMS FOR STUDYING POSSIBILITIES OF SPECTRAL-SELECTIVE SUPPRESSION OF MULTIPLE REFLECTION E. K. Lossovskiy p 57-64 refs (See N69-37984 22-13)

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11. CBD-5000 APPARATUS FOR STUDYING THE EFFECT OF MINE FACE CONDITIONS ON MECHANICAL PROPERTIES OF ROCKS G. V. Artsymovich, E. D. Sklyarev, and M. A. Vin p 85-89 (See N69-37988 22-13)

12. INTERPRETATION OF GEOPHYSICAL FIELD DATA IN ARGILLACEOUS RESERVOIRS T. F. Ponomarchuk p 90-96 refs (See N69-37989 22-13)

13. ELASTIC WAVE VELOCITY DETERMINATIONS BY ACOUSTIC LOGGING G. I. Petkevich p 97-104 refs (See N69-37990 22-13)

N69-37978# Dnepropetrovsk F. A. Artem Mining Inst. (Ukrainian SSR).
PROSPECTING FOR HORIZONTALLY EXTENDED DISTURBING BODIES WITH THE HELP OF GRAVITY ANOMALIES IN MINES
A. A. Yunkov and N. A. Fedorova *In* Akad. Nauk URSR. Geophys. Commun., Issue 23 1968 p 5-15 In RUSSIAN; ENGLISH

summary (See N69-37977 22-13)
Avail: CFSTI

The areas of location of disturbing bodies in the vicinity of a mine are delineated in accordance with the gravity field element within the mine. Author

N69-37979# Dnepropetrovsk F. A. Artem Mining Inst. (Ukrainian SSR).
**SINGULAR POINTS OF ANALYTICAL CONTINUATION OF GRAVITY POTENTIAL DERIVATIVES**
G. Y. Golizdra. *In* Akad. Nauk URSR. Geophys. Commun., Issue 23, 1968 p 16-27 refs In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

The distribution of gravity field singular points in the analytical continuation of the field into masses and beyond them is studied. The investigation is conducted with the utilization of a Cauchy-type integral formula. Expressions for the complex functions in the form of a single-stage integral by a mass outline is derived. The difference in the distribution of singular points for masses with smooth and piecewise smooth outlines are discussed. Examples are presented of the distribution of singular points for several disturbing bodies. Author

N69-37980# Akademiya Nauk URSR, Kiev.
**SELECTION OF INITIAL APPROXIMATIONS FOR SOLVING REVERSE PROBLEMS BY THE METHOD OF STEEPEST DESCENT**
E. G. Butakh and V. E. Loginov. *In its* Geophys. Commun., Issue 23, 1968 p 28-31 refs In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

A method of selection of initial approximations of a geological scheme for solving reverse problems by the trial-and-error technique using digital computers is considered. Author

N69-37981# Akademiya Nauk URSR, Kiev.
**INTENSITY OF SUM MULTIPLE REFLECTION IN LAYERED MEDIA**
E. K. Lossovskiy. *In its* Geophys. Commun., Issue 23, 1968 p 32-43 refs In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

Intensity of sum multiple reflections on idealized models of flat-bedded geological media is studied. An analysis of pulse synthetic seismograms calculated on digital computers by the Baranov-Kunetz method is the basis for the investigations. Author

N69-37982# Academy of Sciences (USSR), Moscow. Inst. of the Earth's Physics.
**DIFFERENTIAL APPROACH TO EVALUATION OF GROUP VELOCITIES OF SURFACE SEISMIC WAVES IN ZONES OF INTERSECTION OF LONG WAVE TRACES**
I. I. Popov. *In* Akad. Nauk URSR. Geophys. Commun., Issue 23, 1968 p 44-46 refs In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

A method of locating crucial blocks of greater or lesser thicknesses is described. The method consists of comparing indicatrices of an azimuthal distribution of group velocities of surface Love and Rayleigh waves by two, or pairwise by several earthquakes. Author

N69-37983# Akademiya Nauk URSR, Kiev.
**TECHNIQUE OF SEISMIC PROSPECTING OF LOWER PERMIAN AND CARBONIFEROUS SUBSALT DEPOSITS IN THE DNIEPER-DON DEPRESSION**
E. P. Puzdrovskiy, O. V. Petrik, and Y. N. Zayakin. *In* Akad. Nauk Geophys. Commun., Issue 23, 1968 p 47-55 refs In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

It is shown that low-frequency interference waves can be easily suppressed by means of geophone arrays and suitable filtering. A dependence is established between the amplitudes of reflected waves and borehole spacing in the linear arrangement of geophones. The recommended spacing of boreholes with ordinary geophone arrays is 20 to 40 meters, and 100 to 120 meters in the case of plane and controlled plane fronts. To increase a seismic record length and get a higher accuracy of tracing the reflected waves, a greater number of elements in an array should be used. Author

N69-37984# Akademiya Nauk URSR, Kiev.
**UTILIZATION OF SYNTHETIC SEISMOGRAMS FOR STUDYING POSSIBILITIES OF SPECTRAL-SELECTIVE SUPPRESSION OF MULTIPLE REFLECTION**
E. K. Lossovskiy. *In its* Geophys. Commun., Issue 23, 1968 p 57-64 refs In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

A complex frequency response of a multilayered medium for reflected waves is considered as a sum of frequency responses of two imaginary media, one producing only first-order reflections, the other only multiples. On this basis for the case of normal incidence, an expression for the frequency response of a filtering device is given, the device being intended for spectral-selective reception of first-order reflections and suppression of the background noise generated in a multilayered medium by multiple reflections. Examples are presented of the calculations of such filters for certain idealized models of geological media. Author

N69-37985# Akademiya Nauk URSR, Kiev.
**TWO TYPES OF MULTIPLES IN THE SIVASH DEPRESSION**
O. M. Kharitonov. *In its* Geophys. Commun., Issue 23, 1968 p 65-73 refs In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

A problem of relations between seismogeological conditions and the mechanism of multiple wave generation is considered. It is shown that certain relationships of multiple wave origination are characteristic of some media. Procedures of determination of multiple types according to the data of the reflection seismic technique are described. These have been used for processing seismic observations in two areas of the Sivash depression. Author

N69-37986# Akademiya Nauk URSR, Kiev.
**APPLICATION OF MAGNETIC SEPARATION IN INTERPRETING MAGNETIC PROPERTIES OF ROCKS**
V. I. Shapoval, O. F. Makiychuk, and N. F. Pesnenskaya. *In its* Geophys. Commun., Issue 23, 1968 p 74-79 refs In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

Development of the magnetic separation technique on granite samples of the Ukrainian shield and gabbro-diorites of Mountainous Crimea made it possible to distinguish pure magnetically monomineral fractions. Determinations of a content and volume of each fraction resulted in establishing correlation between magnetic susceptibility and percentage of magnetite. The data of chemical analyses of the ferriferous components also show distinct correlation with the magnetic susceptibility data. Thus, a quantitative characteristic of the dependence of a magnetic permeation of rocks on their material composition is obtained. Author

N69-37987# Akademiya Nauk URSR, Kiev.
**SPECTROMETRIC SCINTILLATION EQUIPMENT FOR RADIOACTIVE LOGGING OF BOREHOLES IN ORE DEPOSITS**
B. B. Migunov, V. N. Knolin, and S. E. Khamrayev. *In its* Geophys.

Commun., Issue 23 1968 p 80-84 refs In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

Methods of radioactive logging, based on spectrometry of the scattered gamma radiation by special spectrometric equipment, open wide prospects for the increase of the effectiveness of the geophysical investigations in boreholes of ore deposits. A model of the spectrometric equipment was designed and manufactured. Utilization of this equipment, resulted in the ascertaining of its high effectiveness for the solution of a number of problems of geological prospecting which imply not only the problems of lithological subdivision but also a possibility of qualitative determination of iron content in the ferriferous rocks and ores of the Krivoy Rog basin. Author

**N69-37988#** Akademiya Nauk URSR, Kiev.
**CBD-5000 APPARATUS FOR STUDYING THE EFFECT OF MINE FACE CONDITIONS ON MECHANICAL PROPERTIES OF ROCKS**
G. V. Artsymovich, E. D. Sklyarov, and M. A. Vin *In its* Geophys. Commun., Issue 23 1968 p 85-89 In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

Parameters of an apparatus for studying mechanical properties of rocks under high pressures characteristic of a mine face are presented. A description of the apparatus is given. A detailed discussion is presented on the main unit of the apparatus: a high pressure vessel. A rock sample loading scheme is also discussed. Author

**N69-37989#** Akademiya Nauk URSR, Kiev.
**INTERPRETATION OF GEOPHYSICAL FIELD DATA IN ARGILLACEOUS RESERVOIRS**
T. F. Ponomarchuk *In its* Geophys. Commun., Issue 23 1968 p 90-96 refs In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

The problem of distinguishing argillaceous reservoirs by the character of the soaking fluid therein is considered. Results are presented of determinations of porosity coefficients, oil and gas saturation, and oil yield of sandy-siltstone beds by electrical data. Author

**N69-37990#** Akademiya Nauk URSR, Kiev.
**ELASTIC WAVE VELOCITY DETERMINATIONS BY ACOUSTIC LOGGING**
G. I. Petkevich *In its* Geophys. Commun., Issue 23 1968 p 97-104 refs In RUSSIAN; ENGLISH summary (See N69-37977 22-13)
Avail: CFSTI

The stages of the processing of ultrasonic measurements in boreholes on small base lines for the determination of elastic wave velocities are described. The following stages of the processing of acoustic logs are considered: (1) identification of waves and their correlation; (2) discrimination of anomalies on diagrams; (3) determination of acoustic diagrams; (4) determination of interval velocities; and (5) construction of a velocity cross-section. Techniques are used which are commonly applied in seismic prospecting and commercial geophysics. Author

**N69-37996#** Institut Royal Meteorologique de Belgique, Brussels.
**IONOSPHERIC AND COSMIC RAY OBSERVATIONS [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE] Monthly Bulletin, May 1969**
1969 28 p In FRENCH and DUTCH
Avail: CFSTI

Tabulated ionospheric and cosmic ray data derived from observations made at Dourbes in Belgium in May 1969 are presented. ESRO

**N69-38024#** Military Engineering Experimental Establishment, Christchurch (England).
**BLOCK DIAGRAMS OF LANDSCAPES FOR TERRAIN CLASSIFICATION**
C. J. Lawrance Jan. 1968 57 p refs
(TN-6/68) Avail: CFSTI

Diagrams and three types of land projections are presented to describe how physiographic features, characteristic of land systems, are formed. Uganda land systems and the principles of perspective used are included in the survey. E.H.W.

**N69-38093#** Massachusetts Univ., Amherst. Dept. of Geology
**PHOTO-INTERPRETATION STUDIES OF DESERT BASINS IN NORTHERN AFRICA. PART 1 Final Report, Mar. 1963-Jul. 1968**
H. T. U. Smith Jun. 1969 106 p refs
(Contract AF 19(628)-2486)
(AD-689408; AFCRL-68-0590) Avail: CFSTI CSCL 8/7

The study appraises the feasibility of photogeologic methods for estimating nature of surface materials, moisture conditions, relief, and other characteristics of desert basin floors in the Saharan region, using medium-scale Tri-Metrogon photography, in black-and-white. A frame of reference is provided by studies on playas in western U. S., by reports on widely-scattered field observations on African basins, and by available literature on regional geology and geography. Interpretation is based partly on direct evidence from what is seen on photos, and partly on indirect evidence deduced from the geologic context. Results are of a reconnaissance nature, informative as to general characteristics, but more limited with respect to specifics because of the scale, type, and quality of the photos. For more definitive interpretation, supplementary sources of data are required. One general conclusion, however, is that the dry, firm type of playa surface well known in western U. S. is uncommon in the Sahara, and has been recognized only in western part of that region. Author (TAB)

**N69-38138*#** Booz-Allen Applied Research, Inc., Bethesda, Md.
**SYSTEM FOR UPPER ATMOSPHERIC SOUNDING (SUAS). VOLUME 1: SUMMARY**
Mar. 1969 43 p refs
(Contract NAS1-7911)
(NASA-CR-66753-1) Avail: CFSTI CSCL 04A

A comprehensive analysis was made of alternative launch vehicles, payloads, tracking/telemetry, and support to define a sounding system capable of measuring wind speed and direction, temperature, and pressure/density in the atmosphere between 30 and 100 km. Design requirements included relatively low cost, high reliability, simplicity of operation, and capability for worldwide synoptic operations. The following six candidate systems were considered: (1) passive sphere, 7-in. gun-launch vehicle, phased-array tracking radar; (2) passive sphere with transponder, rocket-boosted 3-in.-dia dart, interferometer tracking system; (3) passive sphere, 1 canister of chaff, rocket or rocket-boosted dart vehicle, phased-array tracking radar; (4) spinning-wire densitometer, thermistor/parachute, 5 canisters of chaff, rocket launch vehicle, 2 telemetry ground stations, phased-array tracking radar; (5) molecular fluorescence densitometer, thermistor/parachute, 5 canisters of chaff, rocket launch vehicle, 2 telemetry ground stations, phased-array tracking radar; and (6) Pitot system, thermistor/parachute, 5 canisters of chaff, rocket launch vehicle, 2 telemetry ground stations, phased-array tracking radar. K.W.

**N69-38150#** Bochum Observatory (West Germany).
**ANNUAL REPORT 1967 OF THE INSTITUTE OF SATELLITE AND SPACE RESEARCH [JAHRESBERICHT 1967 DES INSTITUTS FUER SATELLITEN- UND WELTRAUMFORSCHUNG]**
H. Kaminski 1968 27 p In GERMAN
Avail: CFSTI

This annual report deals with the installation of a new

turnstile antenna, design data for reflectors and steering equipment, work on a television telescope, an aerial camera for ground observation of satellites and solar X-ray observations. The Faraday effect, tropospheric influences on microwave transmission, recording of weather satellite pictures, and geographical, climatological and geological investigations in Africa and Greenland are also discussed. Programming work for the computer center is also discussed. ESRO

**N69-38168#** Texas A&M Univ., College Station. Center for Tectonophysics.
**STUDIES IN ROCK FRACTURE Technical Report, 1 May 1968 - 30 Apr. 1969**
John Handin 15 Jun. 1969 48 p refs
(Contract DACA73-68-C-0004; ARPA Order 1074-1)
(AD-689578; TR-1) Avail: CFSTI CSCL 8/7

The study is to evaluate the influence of residual elastic strain on the orientations of tensile and shear fractures in rock. As a first step the three-dimensional state of residual elastic strain was measured by X-ray diffractometry in each of three quartzose sandstones. A prediction was then made concerning the orientations of fractures that would be induced in each rock by loading normal to bedding. The prediction was based upon a knowledge of the prestrain, the applied loads, the maximum tensile stress and Coulomb-Mohr criteria. Each prediction was then tested by experimentally fracturing the rocks. Author (TAB)

**N69-38194#** Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
**BASIC FEATURES OF THE DEEP-SEATED STRUCTURE OF THE URALS**
I. D. Sobolev May 1969 23 p refs Transl. into ENGLISH from the publ. "Osnovnyye Cherty Glubinnogo Stroyeniya Urala" Moscow, Nauka Press, 1968 p 28-37
(AD-689493; ACIC-TC-1525) Avail: CFSTI CSCL 8/7

In the paper the basic structural zones, or first order structures (with the exclusion of the eastern part of the Russian Platform) are discussed. The works of recent years made it possible to explain, in general features, the structure of the buried part of the Ural and to determine that the eastern part of the Ural Paleozoic geosyncline passes in a submeridional direction somewhat to the east of the cities of Tyumen and Kurgan. Author (TAB)

**N69-38196#** Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography.
**ON THE UNDULAR BORE Final Report**
Stanley J. Jacobs Jul. 1969 23 p refs
(Contract NOnr-1224(55))
(AD-690555; Rept-07344-4-f) CSCL 8/3

A study is made of the growth and development of the weak or undular bore. Small amplitude theory is used and the solution is made valid over the time range of interest through a variant of the method of multiple scales. The solution implies the validity of Rayleigh's result for the speed of the bore. Computed wave heights are in qualitative agreement with observations. Author (TAB)

**N69-38209*#** Booz-Allen Applied Research, Inc., Bethesda, Md.
**SYSTEM FOR UPPER ATMOSPHERIC SOUNDING (SUAS). VOLUME 2: TECHNICAL REPORT**
Mar. 1969 275 p refs
(Contract NAS1-7911)
(NASA-CR-66753-2) Avail: CFSTI CSCL 04A

An overall technical analysis of a system for upper atmospheric sounding is presented. Topics include: (1) mission requirements and specifications; (2) sensor analysis; (3) launch vehicle analysis; (4) tracking system analysis; and (5) description of candidate sounding systems. Recommendations are then made for a system design incorporating a passive sphere, one canister of chaff, phased-array tracking radar, and a rocket or rocket-boosted dart vehicle. The development risks of the proposed configuration and operational considerations are also treated, in addition to a detailed cost analysis of the various candidate systems. A.C.R.

**N69-38210*#** Booz-Allen Applied Research, Inc., Bethesda, Md.
**SYSTEM FOR UPPER ATMOSPHERIC SOUNDING (SUAS). VOLUME 3: CONCEPTUAL DESIGN**
Mar. 1969 27 p refs
(Contract NAS1-7911)
(NASA-CR-66753-3) Avail: CFSTI CSCL 04A

The recommended design of the system for upper atmospheric sounding consists of the following elements: (1) launch vehicle; (2) payload composed of a one-meter, aluminized, inflatable mylar sphere and one packet of aluminized chaff; (3) data/acquisition-tracking system; and (4) associated ground support equipment. The system is designed to probe the atmosphere from 30 to approximately 100 km to obtain measurements of wind speed and direction, temperature, and pressure. Basic requirements are low cost, high reliability, simplicity of use, and deployment capability on a worldwide basis. A.C.R.

**N69-38211*#** Booz-Allen Applied Research, Inc., Bethesda, Md.
**SYSTEM FOR UPPER ATMOSPHERIC SOUNDING (SUAS). VOLUME 4: TECHNOLOGY DEVELOPMENT PLAN**
Mar. 1969 28 p refs
(Contract NAS1-7911)
(NASA-CR-66753-4) Avail: CFSTI CSCL 04A

Technological problems which must be solved prior to development of the recommended upper atmospheric sounding system are described, and a time-phase plan for their solution is presented. Difficulties are treated in each of the four system components. Launch vehicle problems involve final design optimization, motor development, and the falling mass hazard. Areas of investigation for the payload subsystem include the payload ejection mechanism, sphere drag coefficient analysis, and sphere fabrication. Tracking and data acquisition specifications are discussed, as well as general considerations such as site design specifications, synoptic system design, and system reliability and maintainability. A.C.R.

**N69-38258#** Pisa Univ. (Italy). Istituto di Geodesia e Topografia.
**THE CHARTS WITH TOPOGRAPHIC ISOSTATIC REDUCTION LINES, RELATIVE TO AN ENTIRE REGION, EXTENDED TO ALL THE NATIONAL TERRITORY INDICATING THE NUMBER OF HAYFORD SUBDIVISIONS [LE CARTE DELLE LINEE DI UGUALE RIDUZIONE TOPOGRAFICO-ISOSTATICA RELATIVE ALL'INSIEME DELLE ZONE INDICATE CON NUMERO NELLA SUDDIVISIONE DI HAYFORD, ESTESE A TUTTO IL TERRITORIO NAZIONALE]**
Silvio Ballarin 1968 14 p In ITALIAN /ts Ser. 26, No. 1221 (Publ-62) Avail: CFSTI

Using the topographic-isostatic reductions relative to the zones indicated by the observed gravity values, isabnormality charts of equal reduction are constructed for Italy. A brief description of the criteria adopted, and the norms developed for the evaluation of the reductions applied to the observed gravity values to retain topographic features are presented. Transl. by F.O.S.

**N69-38303#** Naval Postgraduate School, Monterey, Calif.
**THE TOPOGRAPHY OF THE MID-PACIFIC MOUNTAINS**
Charles Keith Roberts (M.S. Thesis) Dec. 1968 43 p refs
(AD-689728) Avail: CFSTI CSCL 8/10

A recently contoured set of detailed bathymetric charts of the central Pacific Ocean were obtained from the Scripps Institution of Oceanography. The mean topography of the submerged Mid-Pacific Mountain chain was contoured from mean depths calculated for one-degree squares. The hypsometry of this area was

determined. A study of the subsidence of the Mid-Pacific Mountains was made using the guyot information available on the charts and in the literature. The guyot data were examined and the dimensions of the 17 most reliable features were studied. The guyot tops are generally deeper in the eastern part of the area than to the west, with an apparent tilt of about 200 fathoms in 1200 nautical miles. The present topography closely resembles the old topography when the guyots were at the surface. It appears that the tops of the mountains have settled a bit relative to the deeper areas, although this is not proven. Author (TAB)

**N69-38310#** Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
**PROSPECTS OF THE WORK OF THE CENTRAL SCIENTIFIC RESEARCH INSTITUTE OF GEODESY, AERIAL SURVEY AND CARTOGRAPHY IN THE FIELD OF THEORETICAL GEODESY [PERSPEKTIVY RABOT TSNIIGAIK V OBLASTI TEORETICHESKOI GEODEZII]**
L. P. Pellinen Apr. 1969 11 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no 7, 1968 p 7–10
(AD-689489; ACIC-TC-1524) Avail: CFSTI CSCL 8/5

In recent years, the solutions to the problems of the figure of the earth and its gravitational field have been greatly supplemented. To cope with these problems, the Central Scientific Research Institute of Geodesy, Aerial Survey and Cartography has created a new division of theoretical geodesy. This work discusses the tasks to be accomplished. Certain methods for determining the coordinates of the earths surface in a single system are evaluated. These methods are the astronomic-geodetic method, the astronomic-gravimetric method, the geometric satellite method and the dynamic satellite method. The study of rapid changes of coordinates connected with the movement of the poles is directly related to the problems of static geodesy. This problem is in the center of attention in the realm of cosmic geodesy research and is of importance to any method studying the earths figure since all of the methods utilize astronomic coordinates. Author (TAB)

**N69-38370#** Defense Documentation Center, Alexandria, Va.
**OCEANOGRAPHY, VOLUME 1 Bibliography Report, Jan. 1963–Jun. 1968**
Jun. 1969 645 p refs
(AD-689700; DDC-TAS-69-36-1) Avail: CFSTI CSCL 8/10

The bibliography is Volume I of a two-volume set on OCEANOGRAPHY and associated subjects. Entries include references to marine life, ocean waves, tides, currents, properties of sea water and ice ocean-bottom topography and composition, equipment, and oceanographic vessels. Author (TAB)

**N69-38376#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
**CARTOGRAPHIC AND GEODETIC SURVEYING REPORTS, SERIES 1: GERMAN CONTRIBUTIONS AND INFORMATION, NO. 40 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN, REIHE 1: DEUTSCHE BEITRAEGE UND INFORMATIONEN, HEFT NR. 40]**
1969 73 p *ref* In GERMAN
Avail: CFSTI

The following four articles on reproduction processes in cartography are presented: (1) a state-of-the-art review of photocomposition in cartography which stresses economy and efficiency of operation, gives a listing of equipment and manufacturers, and treats in detail a late German model in use at the Geodetic Institute; (2) a review of current uses of halftone reproduction and special contact hachure techniques in cartography; (3) a brief description of a method for updating map originals on transparent plastic by means of engraving; and (4) an evaluation of present possibilities for the production of three-dimensional maps having a stereo effect when viewed with the naked eye. Transl. by K.W.

**N69-38393*#** Booz-Allen Applied Research, Inc., Bethesda, Md.
**SYSTEM FOR UPPER ATMOSPHERIC SOUNDING (SUAS). VOLUME 5: PROGRAM DEVELOPMENT PLAN**
Mar. 1969 102 p refs
(Contract NAS1-7911)
(NASA-CR-66753-5) Avail: CFSTI CSCL 04A

A program development plan for the proposed System for Upper Atmospheric Sounding (SUAS) on a worldwide basis is advanced. The system is to operate within existing subsystems on the region between 30 and 100 km. Current and projected technology were exhaustively reviewed and a cost/trade-off analysis of competing subsystems was accomplished prior to the completion of this program development plan. A launch vehicle and launcher, a payload, a data-acquisition/tracking system and associated ground support equipment are essential components of the system. Complementary to this system is a research program consisting of 100 launch sites, each firing about 100 rockets annually. Technical descriptions are given of all subsystems, the implementation of reliability and quality control procedures, management planning and the assignment of supervisory responsibilities, review and reporting procedures, and procurement and scheduling procedures. A summary of manpower and facilities requirements is provided. Long-term gains are anticipated as improved long-term weather forecasting, weather modification, safer and more economical air travel, and improved space reentry. M.H.E.

**N69-38475#** Rand Corp., Santa Monica, Calif.
**MODIFICATION OF THE IONOSPHERE BY RADIOWAVES**
R. E. Lelevier Jun. 1969 29 p refs
(AD-689662; P-4125) Avail: CFSTI CSCL 4/1

A theoretical model is presented for calculating the heating and hydrodynamic expansion of the F-layer of the ionosphere due to an incident radiowave. We find that the greatest effects occur for transmitter frequencies just above the critical frequency of the F-layer. Using a power aperture product of 1,000 sq megawatt-meter, which corresponds to a projected experiment by ESSA at Boulder, Colorado, we find a maximum increase in the electron temperature at the peak of the F-layer of about thirty percent with a reduction in the electron density of about ten percent. The time scale for achieving the density changes is predicted to be about one-half hour to an hour. Author (TAB)

**N69-38476#** Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany).
**ATMOSPHERIC AEROSOLS BETWEEN 700 AND 3000 M ABOVE SEA LEVEL. PART 3: A STUDY OF THE EFFECTS OF ATMOSPHERIC FINE STRUCTURE CHARACTERISTICS ON THE VERTICAL DISTRIBUTION OF AEROSOLS Final Technical Report, Jan. 1968–Jan. 1969**
Reinhold Reiter Jan. 1969 105 p refs
(Contract DAJA37-68-C-0331)
(AD-689478) Avail: CFSTI CSCL 4/1

The report presents an extensive body of observational data and a preliminary evaluation of the data. The mean vertical mass exchange coefficient between 700 and 1800 m and 1800 and 3000 meters were computed from measurements of RaB concentration at three levels. Incremental exchange coefficients of small, vertical adjoining layers (usually 100 m thickness) between 700 and 1800 m were determined from aerological sounding of particle concentration from electrical conductivity measurements. The exchange coefficients are related to the mean lapse rates, stability energy and maximum local lapse rates in inversions. The effect of air mass changes, heat of condensation and wind shear are discussed. Lapse rates during the measurements ranged from +0.3c/100 meters to 1.1c/100. Computed exchange coefficients vary from 0 to 1000 g/cm/sec. The relation between temperature gradient and exchange coefficient shows considerable scatter, especially in the 800-1800 meters region. The region from 1800-3000 meters shows less scatter. Regression lines show a change of slope at lapse rates of about -0.2c/100 meters at the

lower levels and at about 0.5c/100 at the higher region. Author (TAB)

N69-38531# Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Telecommunications Research.
**A THEORETICAL INVESTIGATION OF THE F REGION OF THE IONOSPHERE**
Marsha R. Torr and D. G. Torr 1969 86 p refs
(CSIR-271) Avail: AEC Depository Libraries

The current observational data concerning electrons precipitated into the ionosphere are examined critically. It is shown that the experimental evidence favoring the theory that particles produce a marked effect on the ionosphere is steadily mounting and is strengthened by the results obtained by solving the time-dependent ionospheric continuity equation, taking into consideration the effects of an influx of energetic electrons, atmospheric winds, and thermal nonequilibrium and nonlinear recombination-type loss processes. It is found that inclusion of a corpuscular source of ionization offers an explanation for the behavior of the quiet F layer, for its maintenance during the night, and for certain ionic distributions observed at a high- and a mid-latitude station. It is found that the diurnal variation in precipitated electron flux must follow the solar ultraviolet diurnal variation fairly closely. Author (NSA)

N69-38574# Washington Univ., Seattle. Dept. of Physics.
**ELECTRON-ATOM/ION-ION COLLISION Final Report, 1 Jul. 1965 - 30 Jun. 1968**
Ronald Geballe 16 May 1969 8 p refs
(Contract Nonr-4868(00))
(AD-689849) Avail: CFSTI CSCL 04/1

The physics department of the University of Washington has studied electron-atom and ion-ion collision phenomenon and investigated airglow and afterglow mechanisms. The technical research accomplished and that anticipated is indicated by the paper. The reader is referred to the technical journals listed in an appendix for specific details. TAB

N69-38593# McDonnell-Douglas Co., Huntington Beach, Calif. Douglas Advanced Research Labs.
**ABUNDANCES AND DISTRIBUTION OF ELEMENTS**
Jack Green Feb. 1969 85 p refs /*Its* Res. Commun. No. 91
(AD-690071) Avail: CFSTI CSCL 7/2

The attached report reviews sources of data on element distribution and abundances in the major geospheres. Recent data on the composition of the lunar surface are included. Modern trends in geochemical research are defined. Author (TAB)

# 14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-37363# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
**A PHOTO-ELECTRIC TRISTIMULUS COLORIMETER [EEN FOTO-ELECTRISCHE TRISTIMULUS KLEURPUNTMETER]**
A. J. Hoelen [1969] 40 p refs In DUTCH; ENGLISH summary
(IZF-1969-C2; TDCK-52856-2) Avail: CFSTI

The design of a photoelectric tristimulus colorimeter is described. The most important components of the instrument are a photomultiplier tube and three correction filters. Each filter is composed of an interference wedge and an appropriate template. A general derivation of the shape of the template is given. Also included are results of measurements performed with the instrument and the construction details of the apparatus. Author

N69-37382# Compagnie Francaise Thomson Houston-Hoscle kiss Brandt, Paris.
**RECENT PROGRESS OF THE LESIUM VAPOR MAGNETOMETER OF THE 'SERVO' TYPE [PROGRES RECENTS SUR LE MAGNETOMETRE A VAPEUR DE CESIUM TYPE 'ASSERVI']**
J. L. Meilleroux [1969] 45 p refs In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969 Sponsored by Marine Nat. Franc., DRME, and Ce. Gen. de Geophys.
(CSF-69-76/1/R) Avail: CFSTI

The cesium vapor magnetometer is based on the measurement of the magnetic resonance frequency of cesium atoms. This frequency is proportional to the value of the magnetic field in the environment. The excitation and the detection of the resonance are made possible by means of optical pumping. The control of the generator at the center of the resonance line allows one, either by counting or by frequency discrimination, to obtain either the absolute value or the fluctuations of the magnetic field. The magnetometer is described and recent improvements are discussed. ESRO

N69-37387# Compagnie des Compteurs, Montrouge (France).
**PERFORMANCES OF NEW nmr MAGNETOMETERS USING DYNAMIC POLARIZATION BY ELECTRON PUMPING [PERFORMANCES OBTENUES AVEC LES NOUVEAUX MAGNETOMETRES A RESONANCE MAGNETIQUE NUCLEAIRE UTILISANT LA POLARISATION DYNAMIQUE PAR POMPAGE ELECTRONIQUE]**
R. Miquel [1969] 15 p refs In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969
Avail: CFSTI

The use of nmr magnetometers for measuring small magnetic fields (< 1 gauss) is discussed. Two models are described, one records the geomagnetic field with a sensitivity of 4 milligamma/mm, the other is a digital recorder with increments of 1, 1/2, 1/4 gamma which can be connected either to a printer or to a punching machine. Accuracy and sensitivity of these devices are discussed. ESRO

N69-37422# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).
**OPTICAL PUMPING MAGNETOMETER USING MERCURY ISOTOPES [MAGNETOMETRE A POMPAGE OPTIQUE SUR LES ISOTOPES DU MERCURE]**
G. Hanuise 1969 8 p refs In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969
(ONERA-TP-711) Avail: CFSTI

A magnetometer intended to measure weak magnetic fields is described. It is formed of a cell containing mercury 199 and mercury 201 isotopes. ESRO

N69-37473# Toulouse Univ. (France). Laboratoire de Magnétisme et d'Electronique Quantique.
**ELECTRON RESONANCE MAGNETOMETER: PERFORMANCE OPTIMIZATION [UN MAGNETOMETRE A RESONANCE ELECTRONIQUE: OPTIMISATION DES PERFORMANCES]**
D. Bourdel, F. Lopez, and J. Peadie [1969] 5 p refs In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969
Avail: CFSTI

The design of a magnetometer based on electron paramagnetic resonance is discussed and characteristics for optimizing the performance analysed. ESRO

**N69-37474#** Academia R. P. R., Jassy. Centre de Recherches Physiques.
**RECORDING OF GEOMAGNETIC PULSATIONS USING SATURATED CORE MAGNETOMETERS [ENREGISTREMENT DES MICROPULSATIONS GEOMAGNETIQUES UTILISANT DES MAGNETOMETRES A NOYAU SATURE]**
A. Moldovanu [1969] 9 p refs In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20–23 May 1969
Avail: CFSTI

A saturated core magnetometer is described. It gives recordings of geomagnetic pulsations with a sensitivity of 0.1–0.2 gamma/mm. The addition of a bandpass filter prevents a calibration shift.
ESRO

**N69-37489#** Centre National de la Recherche Scientifique, Garchy (France). Centre de Recherches Géophysiques.
**CONTRIBUTION TO THE STUDY OF INDUCTIVE MAGNETIC SENSORS FOR MAGNETO-TELLURIC SURVEYS. STUDY OF SENSITIVITY AND IMPROVEMENTS [CONTRIBUTION A L'ETUDE DES CAPTEURS MAGNETIQUES A INDUCTION POUR LA PROSPECTION MAGNETO-TELLURIQUE. ETUDE DE LA SENSIBILITE ET AMELIORATIONS]**
Yves Benderitter and Lucien Le Donche [1969] 6 p In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20–23 May 1969
Avail: CFSTI

The sensitivity of inductive magnetic sensors used in geophysical surveys is discussed. Two models are presented, one for use in the horizontal position, the other one for use in the vertical position. Some improvements in the sensitivity are introduced by adding Mu-metal (permalloy) disks.
ESRO

**N69-37505#** Strasbourg Univ. (France). Inst. de Physique.
**AUTOMATIC COMPENSATION DEVICE FOR GEOMAGNETIC FIELD VECTOR [DISPOSITIF DE COMPENSATION AUTOMATIQUE DU VECTEUR CHAMP MAGNETIQUE TERRESTRE]**
Guy Argence [1969] 6 p refs In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20–23 May 1969
Avail: CFSTI

The described device represents the most general case where a system of local supression of a magnetic field is required. The coherent system of automatic supression of the three components of the geomagnetic field can be considered as a standard measuring device of these three components, independent of the nature of the probes used. It is shown that the use of suspended magnets as type of sensors for the horizontal components is particularly appropriate for the matrix system of compensation.
ESRO

**N69-37514#** Ecole Normale Supérieure, Paris (France). Laboratoire de Physique.
**SENSITIVE MAGNET VARIOMETER FOR DECLINATION MEASUREMENT [VARIOMETRE SENSIBLE A AIMANT POUR LA MESURE DE LA DECLINAISON]**
Jean Moenier [1969] 6 p In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20–23 May 1969
Avail: CFSTI

A device is described for measuring small variations of the magnetic declination. It uses two different light sources modulated in the same manner but in opposition phase, one being reflected by a mirror moving with the magnet and the other one by a north-south oriented fixed mirror.
ESRO

**N69-37522#** Stanford Research Inst., Menlo Park, Calif.
**OPTICAL ABSORPTION METER Final Report, 28 Jun. 1968–1 Apr. 1969**
G. D. Gilbert, R. C. Honey, R. E. Meyers, and G. P. Sorensen Apr. 1969 64 p refs
(Contract N60530-68-C-1423)
(AD-689233) Avail: CFSTI CSCL 14/2

The report describes the second-generation absorption meter (a-meter). The system uses two self-powered pulsed light sources and two detectors. One source is equidistant from the two detectors and provides an in-situ calibration method. The other source is located about one-third as far from one detector as from the other detector. The detectors and light sources operate at ambient pressure, in contact with the water. Fifty-ohm coaxial line is used to transmit the signals to the deck. A solid-state circuit on deck provides measured values of a (the absorption coefficient) directly on a digital voltmeter. A signal is also provided with which to drive a chart recorder.
Author (TAB)

**N69-37531#** European Space Research and Technology Center, Noordwijk (Netherlands).
**THE MEASUREMENT OF THERMAL SURFACE PROPERTIES**
M. J. Downey and G. Schamlé *In* ESRO Environments and their Role in Spacecraft Technol. Vol. 2: Feb. 1969 32 p refs
(See N69-37526 22-33)
Avail: CFSTI

The equipment used for the measurement of thermal properties of surfaces at satellite temperatures is reviewed. The equipment in use at ESTEC, e.g. optical equipment for absorptance and for emittance measurements, thermal equipment for measurement of the ratio, and portable equipment for direct work on satellites is described. Some information is given on the laboratory simulation of space environment.
Author (ESRO)

**N69-37578*#** Perkin-Elmer Corp., Pomona, Calif.
**LABORATORY CONTAMINANT SENSOR DEVELOPMENT Final Report**
Jul. 1969 169 p refs
(Contract NAS1-8258)
(NASA-CR-66826; SPO-20227) Avail: CFSTI CSCL 14B

The contaminant sensor developed was modified to increase its sensitivity; the performance of the modified instrument was evaluated with fifty-five test contaminants. Many of the contaminants tested can be detected at concentrations of less than one part per million. A linear relationship exists between the mass spectrometer signal at the maximum of the desorption curve and the amount of contaminant sorbed. For contaminant-air mixtures prepared by dilution, the reproducibility of the overall process is about twenty-five percent on the average for concentrations in the range from 0.5 to 10.0 parts per million. The major source of variability is believed to be in the technique used to prepare the mixtures. The reproducibility of the analytical technique is estimated to be ten percent from earlier work. For some compounds, notably alcohols and certain sulfur compounds, quantitative analysis is limited to concentrations greater than one part per million by some apparently irreversible sorption process occurring in the system. Results of this program have demonstrated the general capability of this instrument for the detection and identification of contaminants at low concentrations in atmospheric samples.
Author

**N69-37580#** Royal Observatory, Edinburgh (Scotland).
**AN ON-BOARD CALIBRATION UNIT FOR THE LIEGE-EDINBURGH ULTRAVIOLET STELLAR PHOTOMETERS IN THE TD1 SATELLITE**
G. C. Sudbury 1968 9 p refs Presented at the Symp. on Calibration Methods in the Ultraviolet and X-ray Regions of the Spectrum, Munich, 1968 *Its* Commun. No. 60
Avail: CFSTI

The ultraviolet part of the Liège – Edinburgh stellar experiment will use the controlled scan to map the sky photoelectrically in four wavelengths in the 1200 to 3000 Å region. There are three reasons for requiring a calibration unit as part of the flight model.

Scientifically, in-flight observations should be related to an absolute scale. There is a substantial risk of contamination vitiating the instrument in the time between full laboratory calibration and flight. Some check is needed on the continuing functioning of the detector system during integration. The EMR cold cathode xenon source is suitable for in-flight calibration and has an appropriate spectral output. A reliable compact power source is also feasible. Several alternatives are available for the optical path through the instrument; the chosen solution is a compromise based on the demands of simplicity, veracity, and the need to present a suitable flux level at the detectors. Author

**N69-37594#** Aktiebolaget Atomenergi, Stockholm (Sweden). Section for Instrumentation.

**VANADIUM BETA EMISSION DETECTORS FOR REACTOR IN-CORE NEUTRON MONITORING**

I. O. Andersson and B. Soderlund Jun. 1969 26 p refs

(AE-359) Avail: CFSTI

In-core flux measurements are becoming increasingly important in both power reactors and test reactors. In particular power distribution measurements in large power reactors have to be performed with a great number of neutron detectors capable of withstanding high integrated flux values. This report presents a summary of the development and application of a new type of nuclear radiation sensor, a beta emission detector, for measurements at high neutron flux levels. The work has been the basis for a type of neutron detector employed in the Marviken in-core system as well as for other types. The report described the design and principle of operation, experiments and tests. Also included are the results and comments from a long-term irradiation of some detectors in the Halden reactor. Author (ESRO)

**N69-37598#** Exeter Univ. (England).

**DESIGN AND USE OF A GRADIOMETER CONNECTED RUBIDIUM MAGNETOMETER**

C. Osgood [1969] 6 p Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, May 1969

Avail: CFSTI

An experiment is described which aims at studying the effects of a coastline on geomagnetic micropulsations. Rubidium oscillators located in two different positions record the values of the local geomagnetic field. The design of the gradiometer is explained and results are discussed. The instrument proved to be very sensitive and magnetic field differences of less than 100 milligamma have been detected. However, the interpretation of the results must take into account the standing field direction. ESRO

**N69-37624#** Aeronutronic, Newport Beach, Calif. Ford Scientific Lab.

**SUPERCONDUCTING MAGNETOMETERS WITH SENSITIVITIES APPROACHING 10 SUP -10 GAUSS**

M. Nisenoff [1969] 14 p refs Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969

Avail: CFSTI

A description is given of some magnetometers that have been built based on the principle of flux entry into superconducting cylinders. The sensitivity of such magnetometers is discussed. A schematic diagram of a circuit designed to measure small changes in ambient flux is presented. It counts changes in the flux digitally in units of a quarter of the amplitude of the change. The use of a device for absolute measurement of the magnetic field is explained. ESRO

**N69-37640#** Royal Observatory, Edinburgh (Scotland).

**PHOTOELECTRIC CALIBRATION OF AN ULTRAVIOLET SCHMIDT CAMERA**

C. M. Humphries 1968 7 p refs Presented at Symp. on Calibration Methods in the Ultraviolet and X-ray Regions of the Spectrum, Munich, 1968 *Its* Commun. No. 59

Avail: CFSTI

The absolute intensity calibration of photographic recording stellar ultraviolet instruments using in-flight photoelectric techniques is discussed. In particular, the calibration of a dual sounding rocket experiment consisting of an objective prism Schmidt camera and an ultraviolet photometer is described. During flight, the photometer scans spatially across a portion of the 19° field of view of the camera and provides intensity calibration for the Schmidt photographic data. The spectral sensivity of the camera extends from the visible region to 1850 Å; spectra are recorded on plates coated with Kodak SC5 emulsion. The photmeter has a 2° × 0.1° instantaneous field of view and its passband is determined by two multilayer dielectric reflection filters and a solar-blind photomultiplier giving a peak centred at 2800 Å with half-width about 400 Å. Pulse counting detection is used. The laboratory calibration procedure is described; preliminary results are also given, together with an assessment of the overall accuracy. The combined experiment is due to be flown in a stabilized Skylark sounding rocket during the latter part of 1968. Author

**N69-37677*#** Perkin-Elmer Corp., Pomona, Calif.

**SUMMARY OF THE DEVELOPMENT OF THE SPECIALIZED QUADRUPOLE MASS SPECTROMETER-PHASE 4 Final Report**

May 1969 35 p refs

(Contract NAS5-11045)

(NASA-CR-105906) Avail: CFSTI CSCL 14B

During the past five years, mass spectrometer instrumentation for planetary atmospheric analysis was under development for NASA-GSFC. This report deals with the continued research and development performed to upgrade the instrumentation toward flight hardware. In general, the final configurations of the previous contract were modified to provide for more stable alignments and ease of manufacture. The analytical design, however, remained unchanged. Author

**N69-37688#** Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Service.

**RAINDROP SPECTROGRAPH WITH AUTOMATIC EVALUATION [EIN SPEKTROGRAPH FUER NIEDERSCHLAGSTROPFEN MIT AUTOMATISCHER AUSWERTUNG]**

J. Joss et al 1968 10 p refs Transl. into ENGLISH from Pure Appl. Geophys. (Milan), v. 68, no. 3, 1967 p 240-246 *Its* Ref. 743

Avail: CFSTI

A new spectrometer which gives a continuous record of the size distribution of raindrops is described. The basic principle is the automatic compensation of the force, produced by a raindrop falling upon the rigid receiving system. The spectrometer is able to record the drop-size distribution of very weak as well as very heavy showers (more than 200 mm/h). Up to 200 drops per second with diameters ranging from 0.3 to 5.3 mm sorted into 20 groups can be recorded. An analog computer calculates and integrates simultaneously the rain intensity, the water content in the air W and the radar reflectivity. The precision of the radar reflectivity, calculated from the raindrop spectrum, depends on the rain intensity, the receiving area and the time during exposure. Author

**N69-37683*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**AEROBEE 350, FLIGHT 17.03 GE: INSTRUMENTATION INFORMATION AND CALIBRATION DATA**

J. R. Groves and T. E. Thompson, Jr. Aug. 1969 80 p

(NASA-TM-X-63864; X-721-69-315) Avail: CFSTI CSCL 14B

This document contains a compilation of calibration data and curves for the airborne instrumentation system used on the Aerobee 350, Flight 17.03 GE. Also included are the telemetry allocations, equipment orientation drawings, component data, a

listing of significant planned flight events, and data resulting from preflight tests. Author

N69-37886# Institut Franco-Allemand de Recherches, St. Louis (France).
**HIGH SPEED HOLOGRAPHIC TECHNIQUES IN A BALLISTIC RANGE**
A. Hirth and P. Smigielski. 4 Aug. 1969. 11 p refs
(ISL-T-16/69) Avail: CFSTI CSCL 14E

In most cases, the optical analysis of aerodynamic phenomena in ballistic ranges involves the use of schlieren methods, differential or not differential interferometry, and shadowgraph methods. The choice of the method to be used and the sensitivity required for visualizing a given object need many shots. The use of holography, however, allows solving this variety of problems with a single shot. When the hologram is taken, it is possible to submit it successively, in the laboratory, to all the techniques mentioned above, and this with the sensitivity required. Other applications are interferometry by the double exposure technique and cineholography. Author

N69-37782# Boeing Co., Seattle, Wash.
**EFFECT OF DISPARITY IN PHOTO SCALE AND ORIENTATION ON CHANGE DETECTION**
C. L. Klingberg, C. L. Elworth, and Abraham H. Birnbaum (Army Behavioral Sci. Res. Lab.) Washington Army Behavioral Sci. Res. Lab. Jan. 1969. 41 p refs
(Contract DA-49-092-ARO-92)
(AD-688967; BESRL-TRN-206) Avail: CFSTI CSCL 14/5

Change detection is most complete and reports on target change detected are more accurate when the aerial photos compared are the same scale and are displayed with a common directional orientation. Significant decrement in completeness and accuracy is normally associated with additional increments of scale disparity between the two photos. Both completeness and accuracy were degraded also when the two photos are not displayed in the same directional orientation. A small degree of misalignment, however, appears to affect completeness more than it does accuracy. These results provide clear indication that display systems for comparative cover analysis should include scale rectification and reorientation capability. The functional relationship between scale disparity and orientation misalignment needs to be determined so that rectification capability may be of the required precision. Increasing the time allowed for comparing photos can offset discrepancies in the imagery--or lack of corrective devices--with respect to completness. Author (TAB)

N69-37773# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
**X-SPECTROMETRY WITH PULSE DETECTORS [SPECTROMETRIE X AVEC DETECTEURS IMPULSIONNELS]**
Alain Friant. May 1969. 30 p refs In FRENCH; ENGLISH summary
(CEA-R-3905) Avail: CFSTI

A comparison is made of various types of pulse X-ray detectors (scintillators + photomultipliers, proportional counters, ionization chambers, semiconductor detectors: Si (Li) and Ge (Li)) as well as their associated electronic equipment, from the point of view of the resolving power, detection efficiency and working surface for photons of 100 eV to 100 keV. Semiconductor detectors (Si (Li) up to 50 keV, Ge (Li) from 10 keV to 100 keV) should rapidly find uses in all cases where an excellent resolving power is necessary (in X-fluorescence for example), whereas proportional counters present greater advantages for applications calling for a high detection surface, and also for very soft X-rays because the window of the detector can be very thin. Author (ESRO)

N69-37811# California Univ., Berkeley. Electronics Research Lab.
**A COMPUTER-CONTROLLED SCANNING ELECTRON MICROSCOPE: THE BERKELEY SEM-I/IBM-1800 SYSTEM**
N. C. MacDonald, P. Mueller, and L. Snyder. 20 Dec. 1968. 99 p
(Grants AF-AFOSR-68-1488; NSF GK-2277)
(AD-688579; ERL-68-5; AFOSR-69-1394TR) Avail: CFSTI CSCL 20/6

A description is given of the additional equipment and computer programs necessary to connect an IBM 1800 computer to a scanning electron microscope (the Berkeley Sem-I). System operating procedures are discussed, and explanations and listings of the computer programs are given. Circuit diagrams and tables giving relationships among program variables, computer inputs--outputs, and controls on the console are presented. Author (TAB)

N69-37858# Institute of Nuclear Research, Warsaw (Poland).
**HELIUM CRYOSTAT FOR MOESSBAUER EXPERIMENTS [KRIOSTAT HELOWY DLA EKSPERYMENTOW MOESSBAUEROWSKICH]**
J. Piekoszewski, Z. Rolke, and J. Suwalski. 1968. 14 p refs In POLISH; ENGLISH summary
(INR-1030) Avail: AEC Depository Libraries

A metallic helium cryostat for Mössbauer experiments carried on in transmission geometry is described. The results of testing experiments on external regulation of the temperature of the sample and the Moessbauer pattern of $Y_3Fe_5O_{12}$ obtained at 5°K are also presented. Author (NSA)

N69-37876*# Perkin-Elmer Corp., Pomona, Calif.
**ANALYTICAL STUDY OF CONTAMINANT AND ATMOSPHERIC SENSOR, PHASE 1**
Washington NASA Sep. 1969. 137 p refs
(Contract NAS1-7260)
(NASA-CR-1375; SPO-20224) Avail: CFSTI CSCL 14B

Research was directed towards the modification of the previously designed two gas atmospheric sensor system (mass spectrometer) to measure the partial pressures of oxygen, nitrogen, carbon dioxide, and water vapor within a space vehicle environment. An analytical study of the necessary modifications which would allow the two gas sensor to monitor the atmospheric constituents, selected contaminants, and summation of contaminants has been performed for both helium--oxygen and nitrogen--oxygen atmospheres. Several approaches utilizing the two gas sensor as the basic component were analyzed. The accumulator cell approach offered the most feasible solution of the problems encounted. The results of the study lead to the definition of a contaminant and atmospheric sensor, utilizing the accumulator cell, meeting the performance goals while still having acceptable weight, power, and size specifications. Author

N69-37891# Atomic Energy Commission Research Establishment, Risö (Denmark). Physics Dept.
**A 4-SPECTROMETER WITH LI-SI COUNTERS**
Verner Andersen (Ph.D. Thesis--Tech. Univ. of Den.) Mar. 1969. 89 p refs
(RISO-195) Avail: CFSTI

A 4-spectrometer has been developed. It is provided with solid state detectors placed in a magnetic field from a superconducting magnet. The resolution is 0.8% at 1 MeV and the instrument has been used to measure the conversion coefficients of different gamma transitions which are compared with other existing theoretical and experimental values. The instrument has also been used for measuring the beta shape of $^{32}P$, $^{198}Au$ and $^{203}Hg$. Author (ESRO)

N69-37921# Army Foreign Science and Technology Center, Washington, D.C.
**A 12-CHANNEL HIGH SENSITIVITY SPECTRUM ANALYZER FOR MEASURING LOW-FREQUENCY NOISE**
V. E. Yamnyi. May 1969. 8 p Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved., Priborostr. (Leningrad), v. 10, no. 2, 1967

p 34–36
(AD-689147; FSTC-HT-23-569-68) Avail: CFSTI CSCL 14/2

A high sensitivity parallel-operated spectrum analyzer for measuring low-frequency noise is described. The maximum sensitivity is equal to 1.10 to the minus 15th power v sq/Hz at a frequency of 2 Hz. Author (TAB)

N69-38085# Southeastern Radiological Health Lab., Montgomery, Ala.
**A TRITIUM AIR MONITOR**
A. A. Moghissi, H. L. Kelley, and C. R. Phillips *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 228–234 (See N69-38042 22-22)
Avail: CFSTI

The monitoring of gaseous radionuclides is of particular interest in the determination of efficiency of air cleaning devices. A tritium monitor based on scintillation was developed. The electronic equipment is to a great extent identical to the components used in commercially available liquid scintillation counters. A block diagram of the monitor is shown. Although the monitor was designed primarily for tritium monitoring in air and water, other radionuclides may be detected under proper conditions. Author

N69-38094# McDonnell-Douglas Co., Huntington Beach, Calif. Douglas Advanced Research Labs.
**A WINDOWLESS DIFFERENTIALLY PUMPED RESONANCE SOURCE FOR PHOTOELECTRON AND RADIOLYSIS STUDIES**
Morris J. Weiss Mar. 1969 9 p refs *Its* Res. Commun. No. 95
(AD-690078) Avail: CFSTI CSCL 14/2

Intense resonance line sources for photoionization and photochemical research have been recently developed which in some cases obviate the need for a monochromator. Most of these sources must use LiF windows to separate the high-pressure region of the discharge from the low-pressure region where irradiation takes place. These windows, however, are subject to radiation damage and must be replaced after several hours of continuous use. This paper describes a windowless far-UV light source developed for use in a photoelectron apparatus. Author (TAB)

N69-38144*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**ABSOLUTE RADIOMETERS FOR USE IN BALLISTIC-RANGE AND SHOCK-TUBE EXPERIMENTS**
Roger A. Craig and William C. Davy Washington Oct. 1969 61 p refs
(NASA-TN-D-5360) Avail: CFSTI CSCL 14B

This report is a discussion of the design, calibration, and use of radiometers to measure absolute spectral emission in ballistic range and shock tube experiments. These radiometers are characterized by a frequency response and a dynamic range sufficient to span the widely different frequencies and intensities of calibration and experiment sources. Radiometers discussed consist of a filter (transmission filter or monochromator), a detector (multiplier phototube or infrared photodiode), and a close-coupled amplifier. Response equations are developed that relate the test data to emission from a calibration standard. The principal problems of use of these radiometers (e.g., multiplier phototube stability and saturation, infrared photodiode rise time and linearity, limiting noise, filter side-band transmission and standard lamp operation) are discussed. Three currently operating ballistic range and shock tube applications are described in detail. Author

N69-38164# Iowa Univ., Iowa City. Inst. of Hydraulic Research.
**AN ELECTRONIC TOTALIZER FOR CURRENT METERS**
John R. Glover May 1969 11 p
(Contract DACW45-68-C-0058)
(AD-689456; IIHR-116) Avail: CFSTI CSCL 14/2

Current meters of the Price (cup) and propeller types will continue in the foreseeable future to be the most widely used instrument for measurement of velocities in natural streams and rivers. To provide better resolution and reliability of the meter output, magnetic dray-reed switches are now frequently being used as the contact closing device in these current meters. However, the counting rates at high velocities cannot be audibly discriminated and accurately totalized by the operator; thus, an electronic totalizer was required in order to realize the full potential of these improved switches. The battery-operated totalizer consists of a pulse shaping network, three decade-decoder-display units, and switches for testing and operating. Integrated circuits are employed to minimize size, and the display intensity has been adjusted to be visible in indirect sunlight. Author (TAB)

N69-38272*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**A NEW INTERPRETATION OF THE EXPLORER 17 AND EXPLORER 32 IONIZATION GAUGE DATA AND ITS IMPLICATIONS TO ORBITAL ANALYSIS**
James O. Ballance 11 Sep. 1969 43 p refs
(NASA-TM-X-53998) Avail: CFSTI CSCL 14B

The response of the modified Redhead magnetron density gauges used on the Explorer 17 and Explorer 32 satellites has been analyzed by using the transmission probabilities and time response characteristics due to geometry and gas-molecule/surface interactions. It was found that the very evident fluid dynamic response characteristics of the data required an interpretation which uses low energy and momentum exchange for the gas on the initial wall collisions with total loss of atomic oxygen. An additional signal due to a process, most likely to be recombination, taking place on the wall of the gauge is suggested. For the example used, there is a factor of two between the derived density based on the original assumptions and the density based on the new interpretation. Author

N69-38276# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.
**CARBON METER FOR SODIUM Final Report**
W. Caplinger Mar. 1969 194 p refs
(Contract AT(30-1)-3688)
(UNC-5226) Avail: CFSTI

A meter was developed which continuously measures a quantity related to the carburizing potential of Na. It operates by diffusing C from the Na through a sensing diaphragm into a decarburizing gas. The diaphragm is in the form of a thin (0.010-in.) iron tube, about 3/8-in. diameter, immersed in the Na stream at 1400°F. The decarburizing gas of moist Ar and $H_2$ sweeps over the inside of the Fe tube, reacts with the C, and carries it to a flame ionization detector for analysis. Conditions are so arranged that the C content of the gas is a continuous measure of the C activity of the Na. The sensor measures a wide range of carburizing potentials from that of clean Type-304 stainless steel to an activity corresponding to the saturation of alpha iron by carbon. The complete instrument package includes a carbon meter sensor, a side loop with heaters to allow the sensor to be installed in systems operating at less than 1400°F, a temperature controlling console for the side loop, and a console for analyzing the decarburizing gas. Author (NSA)

N69-38283*# IIT Research Inst., Washington, D.C.
**INSTRUMENT RESUMES FOR SPACE APPLICATIONS EMPLOYING A COMPUTERIZED SEARCH AND RETRIEVAL SYSTEM Interim Report**
Peter Bock and William L. Vest Jun. 1968 141 p
(Contract NAS12-668)
(NASA-CR-98240) Avail: CFSTI CSCL 14B

The objective was to build and maintain a cross-referenced file of existing and proposed space experiment instrumentation

reflecting an accurate and complete picture of the current and historical state-of-the-art. Convenient and automated access to the file was to be provided so that specific instruments may be retrieved on the basis of a wide variety of descriptive criteria. An instrument resume form was designed to summarize information about each instrument. At the termination of the present study approximately 150 resumes from various programs under the auspices of the NASA Space Applications Program Office are included in the master data file. The computer program, dubbed IRSARS (Instrument Resume Search and Retrieval System), can perform the following functions, in any order: (1) expand the file to include new resumes; (2) revise any item within any resume; (3) search the file and retrieve resumes on the basis of specified retrieval criteria; (4) search the file listing all resumes which exhibit any one or as many as possible of a set of specified keywords; (5) print the entire file on blank resume forms; and (6) list by title, spacecraft, and acronym all resumes in the file. Author

**N69-38288*#** Harvard Coll. Observatory, Cambridge, Mass.
**INSTRUMENTATION AND FLIGHT PERFORMANCE OF HCO-NASA AEROBEE 4.185 US HIGH RESOLUTION WAVELENGTH SPECTROMETER**
J. Crawford and W. H. Parkinson May 1969 39 p refs
(Contract NAS5-9274)
(NASA-CR-105967) Avail: CFSTI CSCL 14B

This report investigates and analyzes the performance of the high resolution wavelength spectrometer and the SPC 324 D/B solar pointing control on NASA Aerobee Flight 4.185 US. Flight evaluation indicates the only system failure to have been in the pointing control. The reasons for this failure are discussed. It is possible, study shows, to prevent future failures of this nature with improved reliability control and more clearly defined lines of authority between Harvard and its subcontractors. An outline of suggested new procedures is enclosed. Author

**N69-38371#** Defence Standards Labs., Maribyrnong (Australia).
**HIGH SPEED INSTRUMENTATION OF EXPLOSIVE PHENOMENA**
K. C. Seddon Feb. 1969 21 p refs
(NP-17862; Rept-330) Avail: AEC Depository Libraries

Recent developments in the techniques and equipment used for the high speed instrumentation of explosive phenomena are discussed as the result of a visit to Sweden, Canada and U.S.A. during June – August, 1968. NSA

**N69-38396#** Sandia Corp., Albuquerque, N.Mex. Contamination Control and Process Acceptance Div.
**A HIGH-VOLUME, REAL-TIME AEROSOL MONITOR**
William E. Neitzel Jun. 1969 20 p refs Sponsored by AEC
(SC-DR-69-56) Avail: CFSTI

Research and development work is described for three generations of a high-volume (10 to 50 cfm) aerosol monitor for use in sampling the air in laminar flow clean rooms. The final developmental model has a helium-neon laser as a light source and has demonstrated a high sensitivity to light scattering from particulate contamination at sampling rates 50 to 100 times that of commercially available monitors. While additional testing would be required to analyze the response of the monitor/signal processing system to particle concentration and size effects, the feasibility of the unique design features of the aerosol monitor was demonstrated. This developmental monitor, when coupled to appropriate electronic signal processing instrumentation, is expected to provide industrial and medical users of clean rooms with accurate particle counts without the long lag in pickup detection and recording of low-volume monitors. Author (NSA)

**N69-38429#** Commissariat a l'Energie Atomique, Limeil (France). Centre d'Etudes Nucleaires.
**HOLOGRAPHIC CAMERA IN THE NANOSECOND RANGE**
J. C. Buges and A. Terneaud 1969 2 p Presented at the Conf. on Lasers and Optoelectronics, Southampton, Engl., 25 – 27 Mar. 1969
(CEA-CONF-1276; Conf-690315-1) Avail: AEC Depository Libraries

A brief description is given of a holographic camera that gives ten images, the exposure time of which is one nanosecond. NSA

**N69-38583*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
**THE ACCURACY OF THE HIGH RESOLUTION INFRARED RADIOMETER ON NIMBUS 2**
E. J. Williamson Aug. 1969 16 p refs
(NASA-TM-X-63687; X-622-69-313) Avail: CFSTI CSCL 14B

The high resolution infrared radiometer (HRIR) provided measurements of surface and cloud-top temperatures until the tape recorder on the satellite failed. The data gathered provided meteorologists and geophysicists with information making possible the nighttime mapping of clouds. The HRIR is described, and discussions are included on: grid-print map, source of noise in the HRIR, calculation of the noise equivalent temperature difference, quantization errors, numerical filtering, and temperature averaging. F.O.S.

# 15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

**N69-37303#** Sandia Corp., Albuquerque, N. Mex. Aerothermodynamics Div.
**A REPORT ON THE FIRE IN THE SANDIA 300 PSI AIR STORAGE SYSTEM**
James F. Reed 1969 30 p refs Presented at the Supersonic Tunnel Assoc. Meeting, Dayton, Ohio, 24 – 25 Apr. 1969 Supported by AEC
(PB-183560; SC-DC-69-1722) Avail: CFSTI CSCL 13L

On September 9, 1968, two brass fittings ruptured in the 2 inch line feeding high pressure air from the compressors to the two 2600 cubic foot, 300 psia, storage tanks for the Sandia wind tunnels. The circumstances leading up to and surrounding this incident are described. In addition, a theory on the cause of the accident is proposed, and the steps which have been taken to preclude a recurrence are outlined. Author (USGRDR)

**N69-37325#** Central Mechanical Engineering Research Inst., Durgapur (India).
**REVERSE-GOVERNING OF DIESEL ENGINES OPTIMIZING VEHICLE POWER-PACK PERFORMANCE**
M. M. Suri Dec. 1968 23 p refs Presented at Seminar on Diesel Power, Kharagpur, India, 28 – 30 Nov. 1968
(A-19) Avail: CFSTI

A systematic analysis of speed-torque characteristics inherrent in a turbocharged diesel engine has revealed that a turbocharged engine is a machine that could yield potentially increased torques when the engine speeds are decreased within limited operational speed ranges. The system of fuel injection and governing developed to achieve this torque characteristic is termed 'reverse-governing' and its advantages especially when used in locomotives with mechanical transmissions achieving optimum power-pack performance and efficiency are discussed. The refinements of 'reverse-governing' to shift and relocate best areas of diesel engine operation to suit in-service conditions are made known along with specific examples of the Maybach MD-435 engine to show how the governing envelop has been altered for the diverse requirements of shunting

and mainline applications, alongside the alterations in turbocharger match with the diesel engine, which further optimizes the power-pack performance for each particular application. Author

N69-37389*# Chrysler Corp., New Orleans, La. Space Div.
STUDY ON AN ELECTROSTATIC ZERO-GRAVITY WORK BENCH PROTOTYPE Final Report
G. E. Hagen 23 Apr. 1969 97 p
(Contract NAS8-21385)
(NASA-CR-102238) Avail: CFSTI CSCL 05E

A working prototype of the electrostatic worktable was constructed, consisting of an ion source, a power supply and a biased table. Of a number of types of ion sources tested, the best performance was obtained from a needle point surrounded by a perforated non-conducting box. Tests of the impedance of the ion beam were made at various cabin pressures. The table was then turned on its side, and objects were suspended in front of it by threads to simulate weightlessness. Forces produced at various heights above the table were determined. Objects were suspended in contact with the table and the force necessary to pull them away was measured. In a series of tests pertaining to safety, it was found impossible to receive an electric shock by the ion beam and that an object could not store enough energy from the ion beam to produce a spark capable of causing ignition of flammable objects. A test for ozone showed that the accumulation after an hour was still below the danger point. A test for ultraviolet was negative and X-ray production is not possible with this apparatus. Finally, it was found that the worktable was space qualified from the standpoint of RFI interference. Author

N69-37372 British Hydromechanics Research Association, Cranfield (England). Dept. of Information.
FRICTION OF FLEXIBLE SEALS FOR HYDRAULIC CYLINDERS
C. M. Lang Feb. 1968 17 p refs Transl. into ENGLISH from Maschinenmarkt (Wuerzburg), v. 73, no. 61, 1 Aug. 1967 p 1314–1322
(T-832) Copyright. Avail: Issuing Activity

The friction of O-rings and double U-rings for sealing the piston rod and the piston in hydraulic cylinders depends on the speed, the pressure, the temperature, the lubrication and the properties of the materials. The behavior, significance and applications of flexible rubber seals used in oil-hydraulic systems were investigated experimentally and the results described, taking the properties of the sealing materials into account. It is noted that the same lubricating conditions exist at the sealing interface of flexible seals as in lubricating films of plain bearings. Author

N69-37375 British Hydromechanics Research Association, Cranfield (England). Dept. of Information.
O-RING FRICTION AND LEAKAGE IN HYDRAULIC SYSTEMS
C. M. Lang Nov. 1968 15 p refs Transl. into ENGLISH from Maschinenmarkt (Wuerzburg), v. 73, No. 90, 6 Oct. 1967
(T-874) Copyright. Avail: Issuing Activity

The friction and leakage of O-rings, sealing parts in relative sliding motion, depends on the speed, oil temperature and viscosity, seal material, housing design and surface finish of the mating surface. The results of experiments to investigate these variables (except the two latter) are presented graphically for speeds mainly between 0 and 25 m/sec (5ft/min) and sealed pressures to 40 kp/cm$^2$(600 lb/in$^2$). Author

N69-37414# European Space Research and Technology Center, Noordwijk (Netherlands).
A THEORETICAL ANALYSIS OF A HYDROSTATIC THRUST/JOURNAL AIR BEARING WITH HIGH TORQUE-LOAD CAPACITY
I. Rens Paris ESRO Jan. 1969 70 p refs
(ESRO-TR-39-ESTEC) Avail: CFSTI

Calculations are performed for a hydrostatic air bearing designed to make a wire-suspended single-axis simulator platform insensitive to lateral forces or uneven mass distribution on the platform. The resultant mathematical relations are formulated in terms of dimensionless quantities and programmed for the IBM 360 digital computer, so that calculations for all bearings of the same type can be carried out by means of this programme. Although the bearing described here is a combined thrust/journal air bearing, the calculations for the two parts are carried out separately. This considerably simplifies the calculation, since a coupling of both flow patterns would have greatly complicated the calculation. The influence of this simplification is expected to be small because the normal operational mode of the air bearing is in the vicinity of the zero load. In this case the coupling between the patterns is in theory zero. The calculations performed are related solely to the determination of load-bearing capacity, the bearing stability being left out of account. It was decided not to investigate the stability because this could be done only imperfectly and would involve a considerable amount of mathematical effort. Instead, the stability limits, as well as the influence of the coupling of the two flow patterns, are to be measured on the actual air bearing. Lastly, the bearing torque capacity of the selected bearing is calculated, and the torsional stiffness of the bearing determined. Since previous studies in this field have been principally concerned with thrust or journal bearing load capacity, without considering the bearing capacity with respect to torque effects, the design of and calculations for the bearing have been directed towards maximum bearing-torque capacity. Author (ESRO)

N69-37812 British Hydromechanics Research Association, Harlow (England).
SOME MEASUREMENTS OF LIQUID WALL ATTACHMENT DIVERTER VALVE CHARACTERISTICS
M. J. Fisher and A. Thomson Mar. 1968 21 p refs Sponsored by UKAEA
(RR-942) Copyright. Avail: Issuing Activity

The work described explores the behavior of wall attachment amplifiers acting as liquid diverter valves for use in self draining chemical plant operating with low inlet pressures. Under these conditions gravitational effects become apparent. With the valve in the vertical position, its performance was unsatisfactory as gravitational forces opposed the attachment forces. A valve with a sharp splitter was found to be unstable in the near horizontal position due to water drainage down the passive output leg. A cusped splitter improved the behavior considerably by stabilizing the vortex on the offside of the attached jet. Variations in geometry were investigated covering aspect ratio, splitter shape, splitter distance and control port location. Some transient measurements were also made. Author

N69-37831 Atomic Energy Commission Research Establishment, Risö (Denmark). Electronics Dept.
ENGINEERING PROBLEMS IN OPTICAL CONTROL
P. la Cour Christensen Nov. 1968 17 p
(RISO-M-829; R-32-68) Avail: CFSTI

The report describes some problems concerning the application of optimal control theory for industrial purposes. Some experiments with optimization of conventional controllers are described and the results compared with the optimal state vector feedback system. Author (ESRO)

N69-37847# Du Pont de Nemours (E. I.) and Co., Circleville, Ohio. Research and Development Lab.
FLUID EFFECTS ASSOCIATED WITH WEB HANDLING
K. L. Knox and T. L. Sweeney 16 May 1969 38 p refs revised
Avail: CFSTI

Equations for the separation distance between webs moving in fluids and near curved surfaces are presented. These equations relate the separation distance to the radius of the curved surface,

taking into account the fluid viscosity, web tension, and velocity. These equations were shown to be acceptable by an indirect method which involved measuring the coefficient of friction of film surfaces of known roughness moving across smooth cylinders under various conditions of speed, tension, and radius. Application of these equations to various web handling problems is reviewed. Author

**N69-37918#** Michigan Univ., Ann Arbor. Inst. of Science and Technology.
**A SYSTEM FOR AUTOMATICALLY POSITIONING ASTRONOMICAL DOMES**
J. Maurer Jun. 1969 38 p
(Contract DAHC15-68-C-0144)
(AD-689225; Rept-1386-13-T) Avail: CFSTI CSCL 3/1

This report describes a coordinate conversion computer system which is used to transform azimuth, polar, and declination angles of a three-axis telescope mount into equivalent azimuth and elevation angles. The system uses the resultant angle information to automatically position the astronomical dome associated with the telescope mount. Descriptions of the coordinate transformations which are required of the system and the system design considerations are presented. Calculations required for the selection of servo components are also included. Author (TAB)

**N69-38013#** Pisa Univ. (Italy). Istituto di Elettrotecnica.
**THE COUPLING COEFFICIENTS OF SYNCHRONIZED AND DAMPENED COUPLING STABILITY OF A SYNCHRONOUS MOTOR SUBJECTED TO SMALL AMPLITUDE DISTURBANCES [I COEFFICIENTI DI COPPIA SINCRONIZZANTE E DI COPPIA SMORZANTE NELLA STABILITA PEI SINCRONI SOGGETTI A DISTURBI DI PICCOLA AMPIEZZA]**
G. Mariotti and M. Lemmi-Gigli 1967 19 p refs In ITALIAN
*Its* Ser. 24; No. 1195
(Publ-107) Avail: CFSTI

The provisions of the theory on the analytic functions of complex variables is studied in terms of the inertial effect, the coefficients of synchronized and dampened coupling, the transfer function of the coupling angle, and the synchronous machine coupling with minimum regulation. Quantitative information on the behavior of the machine in the presence of perturbation forces of small amplitude is given, and a procedure for finding the optimum stability conditions is determined. Transl. by F.O.S.

**N69-38048#** Harvard Air Cleaning Lab., Cambridge, Mass.
**FILTERS: REFILTERS, HIGH CAPACITY FILTERS, AND HIGH EFFICIENCY FILTERS, REVIEW AND PROJECTION**
Melvin W. First *In its* Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 65-78 refs (See N69-38042 22-22)
(Contract AT(30-1)-841)
Avail: CFSTI

Technology developments are summarized for chemical warfare gas filters, and reactor containment air filters and prefilters for extending the service life of absolute filters. E.C.

**N69-38049#** Hanford Occupational Health Foundation, Richland, Wash. Environmental Health Sciences Dept.
**FACTORS INFLUENCING HIGH EFFICIENCY FILTER GASKET LEAKAGE**
F. E. Adley and L. L. Sims *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 109-147 *ref* (See N69-38042 22-22)
Avail: CFSTI

Data are presented on the performance of molded polyvinyl chloride HEPA filter gaskets. Tests show their overall performance poorer than the closed-cell neoprene gaskets presently in use. The molded gaskets do not seal adequately around defects in mounting surfaces. They also have a tendency to deform permanently by shearing at compressions above 35%. Recommendations are made for specifying HEPA filter gaskets. Author

**N69-38089#** Junkers Flugzeug- und Motorenwerke A. G., Munich (West Germany).
**DEVELOPMENT OF $LH_2$ FITTINGS [ENTWICKLUNG VON $LH_2$-ARMATUREN]**
Mar. 1969 353 p refs In GERMAN Sponsored by ELDO
Avail: CFSTI

A report is given on the development of several fittings for a liquid hydrogen tank particularly the shut-off, distributing and relief valves and on their connection joints and control units. The development plan (PERT) is outlined and design characteristics and qualification tests are described in detail. ESRO

**N69-38228*#** Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
**SMALL SCALE LUNAR SURFACE PERSONNEL TRANSPORTER EMPLOYING THE HOPPING MODE Annual Report, 1 Mar. 1968 - 28 Feb. 1969**
May 1969 78 p refs
(Grant NGR-05-020-258)
(NASA-CR-105966; SUDAAR-377) Avail: CFSTI CSCL 13F

Work is described which is concerned with the design of a transporter to extend the lunar operating range of Apollo astronauts. The one-man transporter is to have a maximum gross weight from 1000 lb to 1200 lb fully loaded, a payload of about 80 lb (excluding pilot and life support system) when fueled, and a minimum operating range of 10 miles. Ballistically, the hopping is adapted to the low lunar gravitational acceleration of 5.31 $ft/sec^2$. At 45° elevation launch, a velocity of 15 ft/sec results in a horizontal leap of 50 ft in 4 sec, with a maximum horizontal capability of 10.7 ft/sec or 7.3 miles/hr. Experiments to investigate human tolerance of the repeated accelerations necessary for a hopping trip are described. In the absence of firm human tolerance data, the vehicle has been sized for average accelerations of 3 g over 0.3 sec. Propulsion is to be accomplished by expanding gas against a piston. A ten-mile excursion of a 1-man, 1200-lb vehicle should be accomplished with the expenditure of 50 lb of $N_2$ at ambient temperature, or 10 lb of $N_2H_4$ decomposed at 2000°F. Stabilization and control, systems design, lunar soil mechanics, and foot design were also studied. K.W.

**N69-38245#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**STABILITY OF PISTON FLOW MOTION IN A TRAVELING MAGNETIC FIELD**
K. I. Kim [1969] 11 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 2, 1969 p 38-46
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A formula for determining the stability of piston flow motion in a traveling magnetic field is given. It is shown that this question reduces to the problem of stability of motion in the presence of constantly-acting, perturbing forces. On the basis of the second Liapunov method, sufficient criteria for the stability of stream motion relative to some previously assigned quantities are expounded. Author

**N69-38280#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**AN INSTALLATION FOR THE INVESTIGATION OF FRICTION IN A VACUUM IN ELECTRICALLY OR MECHANICALLY CLOSED SYSTEMS**
G. P. Dermiyan Mar. 1969 12 p refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved., Mashinostro. (Moscow), no. 11, 1968 p 47-50
(AD-689816; FTD-MT-24-415-68) Avail: CFSTI CSCL 20/11

An installation for determing frictional losses in geared electrical mechanisms under vacuum is presented. This installation

consists of two identical dc electric motors connected through a set of gears. One of the motors acts as a generator and the other as an electric motor. The power loss of the system due to friction is determined electrically. A schematic of the vacuum chamber and electrical measuring circuit is presented. This installation may be used successfully for determining frictional power losses in planetary and other gear mechanisms. Author (TAB)

N69-38445# Oak Ridge National Lab., Tenn.
**PRELIMINARY EXPERIMENTS WITH THE VISCO SEAL-PUMP CONCEPT IN TURBULENCE**
E. R. Taylor Jul. 1969 92 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2442) Avail: CFSTI

Preliminary experiments were conducted to determine the performance characteristics of large size visco seals functioning simultaneously as a gas and as a sealant fluid pump operating in turbulence. The visco seal-pump conceptual design, the use of the theory based on a static sealant, and the method of testing are presented with the results and evaluation. The preliminary experimentation indicates that the simplicity of the visco seal-pump concept has potential for meeting the high reliability requirements for reactor rotating machinery. Author (NSA)

N69-38524# Douglas United Nuclear, Inc., Richland, Wash. Electrical and Instrument Systems Design.
**STABILITY OF CRW PUMP MOTORS DURING BPA TRANSIENT POWER CONDITIONS**
W. R. Thorson 7 May 1969 15 p refs
(DUN-5767) Avail: CFSTI

The insadequacy of the present relay protection for the 3500 hp synchronous motors during transient power conditions is described and functional requirements for a relay system that will protect the motor during BPA transient faults are described. NSA

# 16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N69-37218# Lincoln Lab., Mass. Inst. of Tech., Lexington.
**EFFECT OF DIFFUSION ON GAIN SATURATION IN CO SUB 2 LASERS**
Hermann A. Haus, Charles Freed, and Clad P. Christensen, Jr. Feb. 1969 32 p refs
(Contract AF 19(628)-5167)
(AD-689397; TR-464, ESD-TR-69-8) Avail: CFSTI CSCL 20/5

The theory of gain saturation of a two-level system is briefly reviewed and then generalized to include an arbitrary number of upper and lower levels; the upper levels are coupled to each other, as are the lower levels. The laser radiation is assumed to induce transitions between one upper and one lower level. In the limit of tight coupling among the upper and lower levels by themselves, the equations reduce to those of a two-level system, with effective relaxation rates that are weighted sums of the relaxation rates of the multilevel system. The relaxation rates occurring in a CO2 laser system are comparatively low so that one would expect spatial diffusion to play an important role in determining saturation. A theory of diffusion is carried through and it is shown that diffusion effects can indeed be important for optical beam diameters of a few millimeters. Finally, experiments on a sealed-off CO2 laser oscillator and amplifier system are reported. Amplifier gain is measured for four different beam radii. The equivalent saturation parameter derived from the measurements decreased monotonically from 97 to 25W/square centimeters as the average input beam radius increased from 0.9 to 2.5 mm in the 3-mm radius discharge tube of the amplifier. TAB

N69-37293*# Raytheon Co., Waltham, Mass. Research Div.
**A STUDY OF HIGH POWER ARGON LASER OPTICS Interim Scientific Report, 20 Jun. - 19 Dec. 1968**
George de Mars, Frank Horrigan, Michael Seidon, and Hermann Statz Jan. 1969 31 p refs
(Contract NAS12-698)
(NASA-CR-86233; S-1132) Avail: CFSTI CSCL 20E

The argon ion laser optical component damage was studied. The findings as to the mechanism of optical degradation were confirmed. Remedial measures which were proposed were tested and found effective. The large spectral width of the output of a cw argon-ion laser utilizing a conventional two-mirror resonant cavity is undesirable for some applications. This problem is most severe with high-power operation. Some characteristics of the argon ion gain medium indicate that narrowing of the spectral output might be accomplished without resorting to cumbersome optical and electro-optical schemes. The spectral properties of the argon ion medium in a simple resonant structure were studied. In particular, the interaction of this system with a low finesse etalon was explored. A greater understanding was gained of the effects on laser output of cross coupling between lasing transitions which share a common energy level. Author

N69-37675# United Aircraft Corp., East Hartford, Conn. Research Labs.
**RESEARCH INVESTIGATION OF PICOSECOND OPTICAL PULSE TECHNOLOGY Quarterly Technical Report, 1 Mar. - 31 May 1969**
Anthony J. Demaria, William H. Glenn, Jr., George L. Lamb, Jr., Michael E. Mack, and Edmond B. Treacy Jun. 1969 25 p refs
(Contract N00014-68-C-0344; ARPA Order-306A-13)
(AD-689548; UACRL-H920479-15) Avail: CFSTI CSCL 20/5

Discussed is work on adiabatic inversion with frequency swept light pulses, propagation characteristics of ultrashort light pulses in resonant media and mode-locking of organic dye lasers. The possibility of obtaining coherent radiation from laser produced plasmas is of great interest and some preliminary experimental and theoretical investigations of this possibility have been carried out. In addition, some experiments to obtain super radiant emission from organic dyes were conducted. Author (TAB)

N69-37889# Commissariat à l'Energie Atomique, Limeil (France).
**RAMAN LASERS [LES LASERS RAMAN]**
Pierre Veyrie (Ph.D. Thesis) Jun. 1969 35 p refs In FRENCH; ENGLISH summary
(CEA-BIB-148) Avail: CFSTI

This paper reviews work on Raman lasers up to January 1968. After recalling the classical Raman effect and quantum theory, the experimental work leading to the discovery of the stimulated Raman effect is described. The various theories that can account for this phenomenon are discussed and anomalies found in liquid Raman laser operations are discussed in terms of beam trapping. Some work on microsecond pulses is also presented. This bibliography ends by a study of gas Raman lasers, including their principles and anomalies. Author (ESRO)

N69-38100*# Hewlett-Packard Co., Beverly, Mass. Frequency and Time Div.-East.
**RESEARCH AND DEVELOPMENT TO OPTIMIZE THE HYDROGEN MASER Final Report, 28 Jun. 1968 - 30 Jun. 1969**
Jul. 1969 63 p refs
(Contract NAS5-11598)
(NASA-CR-105831) Avail: CFSTI CSCL 20E

From the theory of operation of the atomic-hydrogen maser, it is apparent that its performance can be markedly improved by increasing the fraction of hydrogen atoms entering its storage bulb that are in the (F = 1, m = 0) state. In the conventional maser design, the beam of atoms entering the storage bulb contains

principally of a mixture of the desired (F = 1, m = 0) state and the (F = 1, m = 1) state. The latter do not contribute to the maser's oscillation, but degrade it by line-broadening spin exchange collisions with the radiating atoms that provide the maser's output signal. The proposed design uses two hexapole magnets with a space between them in which the component of atomic angular momentum parallel to the applied magnetic field is rotated 180°, atoms in the (F = 1, m = 1) state end up in the (F = 1, m = − 1) state and vice versa. Atoms in the other two states should end up in the same states as before. The first magnet deflects the (F = 1, m = − 1) and (F = 0, m = 0) states out of the beam, and the second deflects those atoms which have undergone the transition into the (F = 1, m = − 1) state out of the beam. By these means, the atoms remaining will be in the desired (F = 1, m = 0) state. Author

**N69-38400#** Centro Informazioni Studi Esperienze, Milan (Italy).
**PROBLEM OF HEALTH PROTECTION FROM LASER RADIATION [PROBLEMI DI PROTEZIONE SANITARIA DALLE RADIAZIONI LASER]**
E. Bazzano and E. Ghislandi May 1968 40 p refs In Italian
Presented at the 14th Natl. Conf. of the Ital. Assoc. for Health Phys. and Protec. from Radiation, Formia, Italy, 29-31 May 1968
(CISE-117; Conf-680535-1) Avail: AEC Depository Libraries

The physical characteristics of laser light and its various types of emission are briefly summarized. The action of laser light on biological systems and its pathological effects are described with emphasis on the lesions of the eye and of the skin. Because of the increasing use of lasers in many diverse fields, the risks of a professional nature for personnel connected with the operation of lasers are illustrated. The importance of preventive and periodic medical controls as well as prophylactic measures are discussed. Author (NSA)

**N69-38404#** Library of Congress, Washington, D.C. Aerospace Technology Div.
**FOREIGN LASER ABSTRACTS, VOLUME 2, NO. 6**
Jun. 1969 96 p refs
(AD-689768; ATD-69-104) Avail: CFSTI CSCL 20/5

The Foreign Laser Abstracts, a monthly publication of the Aerospace Technology Division, Library of Congress, is intended to bring together the current laser research and development papers published in the open-source scientific and technical literature of the Soviet bloc countries. Author (TAB)

# 17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 08 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

**N69-37201#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**RHENIUM-TUNGSTEN ALLOYS AS MATERIAL FOR HIGH-TEMPERATURE THERMOCOUPLES**
S. K. Danishevskiy 6 Mar. 1969 15 p ref Transl. into ENGLISH from Russian conf. paper
(AD-689306; FTD-MT-24-11-69) Avail: CFSTI CSCL 11/6

As part of the program for seeking new thermoelectric materials certain types of thermocouples were developed and tested. W wire, with a diameter of 0.28 - 0.58 mm and a content of 1 - 20 percent Re was used in the experiments. Data are cited to show the thermoelectromotive forces of thermocouples (E) at temperatures of 0 - 2000 degree C, the sensitivity of thermocouples (dE/dt) in the same temperature range, the value of E in relation to changes in the alloys resistivity at 4 different temperatures, and the dependence of the resistivity on an alloys Re content at 4 different temperatures. A special graph, was compiled to facilitate the selection of suitable alloys for the thermocouples. TAB

**N69-37210#** Catholic Univ. of America, Washington, D.C. Inst. of Ocean Science and Engineering.
**A STUDY OF THE EFFECTS OF TEMPERATURE AND OXYGEN CONTENT ON THE CORROSION OF SEVERAL METALS**
Barbara S. Pijanowski and Iqbal Mahmud Jun. 1969 58 p refs
(Contract N00014-67-A-0377)
(AD-689367; Rept-R69-2) Avail: CFSTI CSCL 11/6

The corrosion rates of stainless steels 304 and 316, mild steel, nickel, Monel, Inconel and brass were investigated by electrochemical polarization techniques in 5% aerated and deaerated HCl solutions. Author (TAB)

**N69-37224#** Royal Aircraft Establishment, Farnborough (England).
**THE FATIGUE STRENGTH OF AlMgSi1 (US EQUIVALENT 6061-T6) and AlMg5 (US EQUIVALENT 5056) ALUMINUM ALLOYS UNDER VARIABLE AMPLITUDE (BLOCK PROGRAMME) LOADING [BETRIEBSFESTIGKEIT DER LEGIERUNGEN AlMgSi1 UND AlMg5]**
W. Schutz May 1969 25 p refs Transl. into ENGLISH from Aluminium (Duesseldorf), v. 43, no. 12, 1967 p 750 - 753
(RAE-LIB-TRANS-1356) Avail: CFSTI

The results are presented of variable amplitude (block program) direct stress fatigue tests on centrally notched flat specimens of AlMgSi1 and AlMg5 for which S - N curves are available. The aim of these tests was to obtain data on the cumulative damage behavior of these two aluminium alloys at several values of the stress ratio. Author

**N69-37386#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**TECHNIQUES OF FABRICATION AND TESTING**
*In its* Fuels and Mater. Develop. Program Feb. 1969 p 227 - 289 refs (See N69-37381 22-22)
Avail: CFSTI

Four duplex billets were fabricated from primary W tube shell and Mo bar stock to study the effects of prior work and extrusion preheat on the structure of the final extruded tube. Existing ORNL computer programs were modified to plot contours of the defect sensitivity factor for various configurations of eddy current coil and conductor. The fundamental and applied data needed for a better understanding of the weldability of materials used for nuclear applications are investigated. Tests were also performed on fuel plates using a scanner and radiographic densitometer. J.A.M.

**N69-37391#** National Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
**COMPARATIVE FATIGUE TESTS ON LIGHT ALLOY LUGS WITH NORMAL AND WITH EXPANDED HOLES**
J. Schijve and F. A. Jacobs Aug. 1968 34 p refs Sponsored by Neth. Aircraft Develop. Board
(NLR-TR-68087-U) Avail: CFSTI

Program fatigue tests and constant-amplitude tests were carried out on lugs ($K_t$ = 3.5) from 2024 and 7075 material. Normal lugs and lugs with 3% expanded holes were tested. Variables studied were: remachining of the expanded hole, mean stress and type of alloy. Considerations on residual stresses, applied stresses, stress gradients and crack growth are given to explain the trends observed. Author (ESRO)

**N69-37417#** Atomic Energy of Canada, Ltd., Chalk River (Ontario). Fuels and Materials Div.
**THE EFFECT OF TEMPERATURE DURING DEFORMATION ON THE DEVELOPMENT OF TEXTURE IN ZIRCONIUM ALLOY ROLLED SHEET AND EXTRUDED TUBES**
B. A. Cheadle, S. A. Aldridge, and C. E. Ells Jun. 1969 18 p refs
(AECL-3372) Avail: CFSTI; Atomic Energy of Can., Ltd., $0.50

The crystallographic texture of a Zr-2.5 wt% Nb alloy has

been determined after rolling at several temperatures. After cold rolling most of the basal plane normals are perpendicular to the plane of the sheet. When the material is held in the $\beta$-zirconium phase during rolling, then transformed to the $\alpha$-zirconium phase, a component of basal plane normals is aligned in the rolling direction. Rolling experiments on a Zr-20 wt% Nb alloy showed that this is a direct result of the rolling texture formed in the $\beta$-zirconium. The temperature during extrusion also has an effect on the texture after extrusion, but the relation between rolling and extrusion textures has not been established. Author

**N69-37428#** Bureau of Mines, College Park, Md.
**REFINING ZINC-BASE DIE-CAST SCRAP USING LOW-COST FLUXES**
Dominic Montagna and John A. Ruppert Oct. 1969 14 p ref
(BM-RI-7315) Avail: Issuing Activity

Investigated is an alternate aluminum removal process utilizing low-cost fluxes. Basing the investigation on the metallurgical principle that a reactive impurity can be removed from a less reactive matrix metal by melting under a flux consisting of a salt or oxide of a metal less reactive than the impurity, three separate flux mixtures were studied. In the first flux system, $FeCl_3$ + NaCl (the active component is underlined), part of the aluminum is eliminated by the formation of volatile aluminum chloride and the rest by the creation of a high melting point iron-aluminum intermetallic compound that can be separated from the remaining molten zinc by filtration. Aluminum removal in the second system, $Fe_2O_3$ + $CaCl_2$ + NaCl, is effected by the formation of the iron-aluminum compound and possibly aluminum oxide. The third system, spent sal skimmings—essential a mixture of $ZnCl_2$, $NH_4Cl$, and ZnO, depends solely on aluminum chloride formation. Of the three flux systems investigated, the best results obtained were with system 3. Aluminum was reduced in the molten die-cast alloy from 4.10 percent to 0.01 percent when depleted sal skimmings were used. Author

**N69-37436*#** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
**EFFECT OF NUCLEAR RADIATION AT CRYOGENIC TEMPERATURES ON THE TENSILE PROPERTIES OF TITANIUM AND TITANIUM-BASE ALLOYS**
Charles L. Younger and Fred A. Haley Washington Sep. 1969 53 p refs
(NASA-TN-D-5442) Avail: CFSTI CSCL 11F

An experimental investigation of the effects of reactor irradiation at 17 K on tensile properties of titanium and titanium-base alloys has been conducted in special test loops at the Plum Brook Reactor Facility. Commercially pure titanium, titanium – 5 aluminum – 2.5 tin, titanium – 6 aluminum – 4 vanadium, and titanium – 8 aluminum – 1 molybdenum – 1 vanadium alloys showed significant increases in tensile strength and probable decreases in ductility following reactor exposures up to $10 \times 10^{17}$ fast neutrons per square centimeter. The influences of impurities, preirradiation heat treatment, and postirradiation heat treatment on radiation damage were also evaluated. Author

**N69-37457#** Oak Ridge National Lab., Tenn.
**RADIATION METALLURGY SECTION, SOLID STATE DIVISION Progress Report, Period Ending Jul. 1968**
Feb. 1969 73 p refs
(Contract W-7405-ENG-26)
(ORNL-4334) Avail: CFSTI

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7. THE TEMPERATURE DEPENDENCE OF RADIATION HARDENING S. M. Ohr p 63–67 refs (See N69-37464 22-17)

**N69-37458#** Oak Ridge National Lab., Tenn.
**RADIATION EFFECTS IN ALLOYS AND STRUCTURAL MATERIALS**
D. S. Billington and M. S. Wechsler *In its* Radiation Met. Sect., Solid State Div. Feb. 1969 p 1–2 (See N69-37457 22-17)
Avail: CFSTI

Radiation damage, hardening, and embrittlement were studied in the body-centered cubic metals. The research indicates that the embrittlement is closely connected with radiation hardening, and is thought that the hardening is due to the defect clusters produced by radiation, which serve as barriers to dislocation motion on which plastic deformation depends. Niobium was used for the study, which developed around two major themes: the influence of impurities, especially interstitual ones; and radiation hardening with its relation to the defect clusters. F.O.S.

**N69-37459#** Oak Ridge National Lab., Tenn.
**INHOMOGENEOUS DISTRIBUTION OF TANTALUM AND TUNGSTEN IN ZONE-REFINED NIOBIUM**
R. E. Reed *In its* Radiation Met. Sect., Solid State Div. Feb. 1969 p 3–9 refs (See N69-37457 22-17)
Avail: CFSTI

Autoradiographs, using $\beta^-$ emission, from neutron-activated Ta and W impurities in zone-melted Nb, indicate that these impurities are inhomogeneously distributed, and that they lie in alternate layers of impurity "rich" and "poor" regions that are parallel to the moving liquid-solid interface during melting. NSA

**N69-37460#** Oak Ridge National Lab., Tenn.
**THE EFFECT OF INTERSTITIAL IMPURITIES ON POSTIRRADIATION ANNEALING PHENOMENA IN NIOBIUM**
J. M. Williams, J. T. Stanley, and W. E. Brundage *In its* Radiation Met. Sect., Solid State Div. Feb. 1969 p 9–20 refs (See N69-37457 22-17)
Avail: CFSTI

Results of annealing at 50 to 550°C are reported. Impurity levels, analyzed by chemical and physical methods, are reported along with measurements of internal friction and electric conductivity. Discussions are included concerning the reasons for electric conductivity and internal friction variations. NSA

**N69-37461#** Oak Ridge National Lab., Tenn.
**PSEUDO SNOEK PEAK IN NIOBIUM**
J. T. Stanley *In its* Radiation Met. Sect., Solid State Div. Feb. 1969 p 21–29 refs (See N69-37457 22-17)
Avail: CFSTI

An investigation of the anomalous behavior of the oxygen Snoek peak which developed in irradiated and annealed Nb during internal friction and electric resistivity measurements is described. Evidence is presented to show the Snoek peak pseudo. NSA

**N69-37482#** Oak Ridge National Lab., Tenn.
**RADIATION ANNEAL HARDENING IN NIOBIUM**
S. M. Ohr and R. P. Tucker *In its* Radiation Met. Sect., Solid State Div. Feb. 1969 p 29–33 refs (See N69-37457 22-17)
Avail: CFSTI

The mechanism of radiation anneal hardening in Nb is discussed in terms of dispersed barrier interactions between trapped interstitial impurity atoms and moving dislocations. Defect clusters identified as dislocation loops at a density of $6.1 \times 10^{15}/cm^3$ with an average diameter of 93 Å were observed by transmission electron microscopy in Nb after neutron irradiation. It is postulated that trapped C atoms migrate to radiation-induced defects during annealing and are trapped. The trapped C atoms strengthen the defects as barriers to dislocation motion causing an increase in yield strength. NSA

**N69-37483#** Oak Ridge National Lab., Tenn.
**DISLOCATION CHANNELING IN NEUTRON-IRRADIATED NIOBIUM**
R. P. Tucker and M. S. Wechsler *In its* Radiation Met. Sect., Solid State Div. Feb. 1969 p 33–63 refs (See N69-37457 22-17)
Avail: CFSTI

Transmission electron micrography was used in a study of the features of dislocation channeling in irradiated-and-plastically deformed Nb. Electron beam melted monocrystalline Nb was cold rolled into 0.13 mm thick sheet, annealed at 1050°C in vacuum, irradiated at a neutron flux of 1.8 and $4.4 \times 10^{13}$ neutrons $cm^{-2}/sec^{-1}$ (>1 MeV), and deformed under tension at room temperature. The average grain size in the specimens was 44 $\mu$ and exhibited a preferred grain orientation with [111] nearly perpendicular to the surface. A measure of the direction and magnitude of shear displacement produced by channeling dislocations was determined by observation of the offset where microstructural features were crossed by dislocation channels. It is postulated that surface slip lines correspond to dislocation channels and that strain is heavily concentrated in the channels. It was observed that there generally appeared to be no defect clusters within cleared channels when the channel plane was perpendicular to the plane of view. NSA

**N69-37484#** Oak Ridge National Lab., Tenn.
**THE TEMPERATURE DEPENDENCE OF RADIATION HARDENING**
S. M. Ohr *In its* Radiation Met. Sect., Solid State Div. Feb. 1969 p 63–67 refs (See N69-37457 22-17)
Avail: CFSTI

As part of a study to explain the temperature dependence of radiation hardening in metals equations were developed to show the critical temperatures above which thermal activation alone is sufficient to move dislocations past dislocation loops. NSA

**N69-37595#** National Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
**SYSTEMATIC ELECTRON FRACTOGRAPHY OF FATIGUE IN ALUMINIUM ALLOYS**
D. Broek and W. J. van der Vet Nov. 1967 65 p refs Sponsored by Directorate of Mater. Air, RNLAF
(NLR-TR-68002-U) Avail: CFSTI

Numerous measurements of striation spacing were carried out. The relation between striation spacing and crack propagation rate is discussed. The effect of inclusions on fatigue crack propagation is considered and explanations are given for several special features of fatigue fracture surface. The mechanism of striation formation is discussed. Author (ESRO)

**N69-37601*#** Whittaker Corp., West Concord, Mass. Nuclear Metals Div.
**PROPERTIES OF POWDERED TITANIUM ALLOYS Final Report**
Gerald Friedman 15 May 1969 65 p refs
(Contract NAS3-10301)
(NASA-CR-72568; NM-9901.20) Avail: CFSTI CSCL 11F

Titanium alloy powders Ti-6A1-4V and Ti-5A1-2.4Sn made by five different techniques were compared with respect to chemistry and physical characteristics. The powders were hot pressed over a range of temperatures and pressures, and the solid bodies thus formed were further analyzed and compared. The rotating electrode powder-making process was selected as the most suitable technique for producing the required low-oxygen powders. Large blocks were hot-pressed to full density from the two alloy powders. Samples taken from the blocks were tested in tension and under plain-strain conditions at room and at cryogenic temperatures, in the longitudinal and the transverse directions. The powder specimens were compared to wrought samples tested under the same conditions and showed tensile properties equal to or better than their wrought counterparts at all temperatures. No comparison could be made between the wrought and powder fracture toughness specimens, since all but one series of tests produced invalid test results. Author

**N69-37641#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
**DEW TECHNICAL REPORTS, VOLUME 9, No. 2 [DEW-TECHNISCHE BERICHTE, BAND 9, HEFT 2]**
1969 299 p refs In GERMAN; ENGLISH summaries
Avail: CFSTI

This document contains reports on the metallurgy and metallography of high-temperature high strength steels and heat resistant alloys, and describes production engineering at the Deutsche Edelstahlwerke, Krefeld. In particular, melting, remelting, hot working, machining of high strength materials, quality control, standardization of steel composition, properties of chromium, nickel, cobalt and austenitic high strength steels are discussed. Also problems of powder metallurgy, dispersion hardening, whisker reinforced metals, solubility and phase formation processes, the creep behavior and corrosion resistance are treated. For individual titles, see N69-37642 through N69-37674. ESRO

**N69-37642#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
**PRODUCTION OF HIGH-TEMPERATURE STEELS AT THE DEUTSCHE EDELSTAHLWERKE A.G. PART 1: PRODUCTION PROGRAM AND SPECIAL PRODUCTION METHODS [ERZEUGUNG HOCHWARMFESTER WERKSTOFFE BEI DER DEUTSCHEN EDELSTAHLWERKE A.G. TEIL 1: ERZEUGUNGSPROGRAMM UND BESONDERHEITEN DER VERFAHRENSWEGE]**
Horst Spitzer *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 64–69 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

A survey is given of the different types of steels with high strength at elevated temperature, their chemical composition and the different forming and metal working techniques depending on the often narrow temperature region which offers sufficient plasticity. ESRO

**N69-37643#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
**PRODUCTION OF HIGH-TEMPERATURE STEELS AT THE DEUTSCHE EDELSTAHLWERKE A.G. PART 2: SMELTING AND REMELTING [ERZEUGUNG HOCHWARMFESTER WERKSTOFFE BEI DER DEUTSCHEN EDELSTAHLWERKE A.G. TEIL 2: ERSCHMELZEN UND UMSCHMELZEN]**
Wilhelm Biesterfeld, Johannes Blix, Hans Peter Severin, and Hans Joachim Müller-Aue *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 69–73 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

The smelting desoxidation and remelting of high temperature steels from scrap materials is described, differentiating between

chromium steels, austenitic steels, nickel steels. High purity ingots are smelted in vacuum induction furnaces or in vacuum electric arc furnaces, which may also be used for electro-slag remelting. ESRO

**N69-37644#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**PRODUCTION OF HIGH-TEMPERATURE STEELS AT THE DEUTSCHE EDELSTAHLWERKE A.G. PART 3: HOT WORKING AND THERMAL TREATMENT [ERZEUGUNG HOCHWARMFESTER WERKSTOFFE BEI DER DEUTSCHEN EDELSTAHLWERKE A.G. TEIL 3: WARMFORMGEBUNG UND WAERMEBEHANDLUNG]**

Hermann Simon, Otto Brass, Engelbert Wilhelm, and Ernst Welzel *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 73–79 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

The methods and machinery used for metal working of high temperature steels and alloys at the Deutsche Edelstahlwerke Krefeld are described, in particular hot pressing, forging, drop forging, hot rolling and heat treatment. ESRO

**N69-37645#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**PRODUCTION OF HIGH-TEMPERATURE STEELS AT THE DEUTSCHE EDELSTAHLWERKE A.G. PART 4: SEMIFINISHED PRODUCT PROGRAM [ERZEUGUNG HOCHWARMFESTER WERKSTOFFE BEI DER DEUTSCHEN EDELSTAHLWERKE A.G. TEIL 4: WEITERVERARBEITUNG]**

Horst Manfred Mozek, Fritz Steffen, Horst Alfred Uhr, and Dieter Weske *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 79–83 In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

The methods and machinery used at the Deutsche Edelstahlwerke, Krefeld, to produce semifinished material from high-temperature steels and alloys are described, in particular sheet production by rolling with intermediate heating, cold rolling and drawing. Emphasis is placed on the importance of quality control. ESRO

**N69-37646#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**QUALITY AND PRODUCTION CONTROL OF HIGH-TEMPERATURE MATERIALS [QUALITAETSKONTROLLE UND GUETEUEBERWACHUNG BEI HOCHWARMFESTEN WERKSTOFFEN]**

Otto Mülders and Kurt Tesche *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 84–98 In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

The quality and production control procedures adopted at the Deutsche Edelstahlwerke, Krefeld, are outlined, discussing the organizational setup, the quality tests used to check mechanical properties and surface quality, melting processes, and drawing products. ESRO

**N69-37647#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**MELTING AND REMELTING OF HIGH-TEMPERATURE STEELS AND ALLOYS BY VACUUM [ERSCHMELZUNG UND UMSCHMELZUNG HOCHWARMFESTER STAEHLE UND LEGIERUNGEN IN VAKUUM]**

Rolf Diederichs *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 99–109 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

The production of high temperature steels and alloys proceeds by melting, electrode casting and remelting to obtain flawless ingots. From a discussion of the experience gained in vacuum melting and remelting of steels and alloys it appears that if melting and casting proceeds in vacuum, the influence of oxygen and nitrogen is eliminated. Also discussed are the removal of sulfur and phosphorus, the evaporation of alloying elements, and the avoidance of defects in remelted ingot material. ESRO

**N69-37648#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**STANDARDIZATION OF HIGH-TEMPERATURE STEELS AND ALLOYS [NORMUNG HOCHWARMFESTER STAEHLE UND LEGIERUNGEN]**

Heinz Kiessler *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 110–117 In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

The chemical composition and tensile strength of high-temperature steels and alloys are compiled and compared, based on standard specifications of the German aircraft industry. ESRO

**N69-37649#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**HIGH-TEMPERATURE 12% CHROMIUM STEELS [HOCHWARMFESTE12%-CHROMSTAEHLE]**

Herbert Wisniowski *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 117–133 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

Different types of 12% chromium steels, e.g. chromium steels alloyed with molybdenum, but without other carbide-forming elements, and chromium steels with molybdenum and cobalt, and carbide-forming elements are discussed with respect to their creep strength, phase diagrams, metallurgical structure, and cyclic strength. ESRO

**N69-37650#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**HIGH-TEMPERATURE AUSTENITIC STEELS [HOCHWARMFESTE AUSTENITISCHE STAEHLE]**

Albert von den Steinen *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 134–146 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

High-temperature creep resistant steels applied either in short-lived airplane gas turbines or in long-lived ground equipment, which have austenitic structure, are surveyed according to their long-term creep strength, their high-temperature strength and impact strength. The influence of various alloying metals, as niobium, boron, and cobalt, is discussed. ESRO

**N69-37651#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**HIGH-TEMPERATURE MATERIALS ON A NICKEL AND COBALT BASIS [HOCHTEMPERATURWERKSTOFFE AUF NICKEL- UND KOBALTBASIS]**

Karl Bungardt *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 146–162 refs In GERMAN; ENGLISH summary Presented at the Colloq. on Meter. of the Univ. and Nucl. Res. Center, Karlsruhe, Ger., 2 Jul. 1968 (See N69-37641 22-17)

Avail: CFSTI

A survey is given on the present state of nickel and cobalt steel metallurgy, discussing the influence of various alloying elements on creep rupture strength and high-temperature strength and the metallurgical composition of these alloys. Smelting procedures are also outlined. ESRO

**N69-37652#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**ON THE PRECIPITATION BEHAVIOR OF SOME HIGH-TEMPERATURE MATERIALS ON AN IRON, COBALT,**

**AND NICKEL BASIS [ZUM AUSSCHEIDUNGSVERHALTEN EINIGER HOCHWARMFESTER WERKSTOFFE AUF EISEN-, KOBALT- UND NICKELBASIS]**

Gustav Lennartz and Albert von den Steinen *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 163–176 refs In GERMAN; ENGLISH summary Presented at the VDEM Meeting on High Temp. Mater., Düsseldorf, 27 Feb. 1969 (See N69-37641 22-17)
Avail: CFSTI

The influence of intercrystalline precipitations developing during protracted annealing (for up to 10.000 hours) on the creep rupture strength and the impact strength are discussed for steel alloys of varying composition. ESRO

**N69-37653#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**HIGH-TEMPERATURE NICKEL AND COBALT ALLOYS FOR MICROCASTING [HOCHWARMFESTE NICKEL- UND KOBALTLEGIERUNGEN IN FEINGUSS]**

Ernst Günter Nickel and Hanswerner Weinmann *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 177–185 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

The creep rupture strength and the yield strength at elevated temperatures of high temperature nickel and cobalt steels is investigated, discussing the influence of the grain size on yield strength and possibilities of developing a controlled grain structure. More recent types of nickel and cobalt steels are described which have been developed to obtain increased corrosion stability and improved casting properties. Some examples of practical applications, e.g. to turbine blades, are given. ESRO

**N69-37654#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**POWDER METALLURGY OF HIGH TEMPERATURE ALLOYS ON A NICKEL AND COBALT BASIS [PULVERMETALLURGIE VON HOCHTEMPERATURLEGIERUNGEN AUF DER BASIS VON KOBALT UND NICKEL]**

Herbert Grünewald and Peter Kassner *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 186–192 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

A survey is given on the present state of research and development in the field of Co- and Ni-base high-temperature alloy production by means of powder metallurgy. The paper deals first with methods for the production and densification of high-alloyed powders, covering in some detail more recent processes specifically developed for alloy production. The second part summarizes the characteristic mechanical properties of superalloys made by powder metallurgy, comparing them with the properties of current casting and forging grades of identical composition. Developmental efforts and possibilities concerning powder-metallurgical production of new Co- and Ni-base alloys are briefly mentioned, and in conclusion the paper reports on new development trends in this field. Author (ESRO)

**N69-37655#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**DISPERSION HARDENING OF NICKEL BY MEANS OF ALUMINUM OXIDE [DISPERSIONSHAERTUNG VON NICKEL DURCH ALUMINIUMOXID]**

Hanswerner Weinmann, Karl Mauer, and Peter Kassner *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 193–198 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

The preparation of samples and the investigation of mechanical strength at room temperature, of creep strength at 900°C and of hardness values depending on the $Al_2O_3$ content is described. The tensile strength of these materials increases markedly with increasing $Al_2O_3$ content and increasing number of $Al_2O_3$ particles per unit surface. At a volume content of 12% the 900°C creep strength reaches its maximum value. Work hardening also increases creep strength. ESRO

**N69-37656#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**WHISKERS AND WHISKER-REINFORCED METALS [WHISKER UND WHISKERVERSTAERKTE METALLE]**

Herbert Grünewald and Peter Kassner *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 199–204 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

The paper gives a survey on the present state of whisker and whisker-reinforced metal development, dealing first with production and properties of the currently used whiskers and proceeding to theorize on the effect of whiskers in metallic compound systems. Lastly, it reports on production, properties and applications of whisker-reinforced metals. Author (ESRO)

**N69-37657#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**SOLUBILITY OF MOLYBDENUM AND TUNGSTEN IN NICKEL ALLOYS AT 1200°C [LOESLICHKEIT VON MOLYBDAEN UND WOLFRAM IN NICKELLEGIERUNGEN BEI 1200°C]**

Helmut Brandis, Kurt Lehmann, and Karl Wiebking *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 204–213 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

The course of the saturation curve showing solubility of molybdenum and tungsten in various nickel alloys is investigated. Sample casts, after suitable annealing, were subjected to hardness tests. Kinks in the hardness curves and the metallographic study of microstructure for homogeneity or inhomogeneity permitted the determination of the saturation curves. Finally, the individual nickel alloys with varying Mo or W additions were compared to demonstrate the variations of the Ni-base solid solution ranges in the phase diagram. ESRO

**N69-37658#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**INVESTIGATIONS OF THE PRECIPITATION BEHAVIOR OF SMALL QUANTITIES OF BORON IN A 16% CHROMIUM AND 13% NICKEL STEEL [UNTERSUCHUNGEN ZUM AUSSCHEIDUNGSVERHALTEN KLEINER MENGEN BOR IN EINEM STAHL MIT 16% Cr UND 13% Ni]**

Helmut Brandis and Elisabeth Horn *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 213–217 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

The solubility limit of boron in an unstabilized steel with a 16% Cr, a 13% Ni, and a 0.06% C content was determined as a function of the boron content (maximum 0.021%). Above boron contents of 0.009% precipitations occurred along grain boundaries on quenching from 1200° C or from higher temperatures. From electron diffraction studies and the carbon/boron ratio it is concluded, that the solubility of boron in $(Cr, Fe)_{23}C_6$ is very low. ESRO

**N69-37659#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**ON THE INFLUENCE OF MOLYBDENUM AND TUNGSTEN ON THE CREEP STRENGTH AND THE PRECIPITATION BEHAVIOR OF NIOBIUM-STABILIZED 16/16 CHROMIUM-NICKEL STEELS CONTAINING NITROGEN [ZUM EINFLUSS VON MOLYBDAEN UND WOLFRAM AUF DAS ZEITSTAND- UND AUSSCHEIDUNGSVERHALTEN VON STICKSTOFFHALTIGEN NIOBSTABILISIERTEN 16/16 CHROM-NICKEL-STAEHLEN]**

Karl Bungardt, Albert von den Steinen, and Gustav Lennartz *In*

*Its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 218-229 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

The impact strength, creep strength, creep rupture strength, and the hardness were investigated as a function of the molybdenum and tungsten content of various basic nickel and chromium composition steels. The precipitation depends on the interaction of niobium and carbon and on the duration of annealing. Alloys showing higher precipitation exhibit lower creep strengths. ESRO

**N69-37660#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
**INVESTIGATIONS OF PHASE TRANSFORMATIONS IN NICKEL-CHROMIUM ALLOYS WITH VARYING CHROMIUM CONTENT [UNTERSUCHUNGEN UEBER ZUSTANDSAENDERUNGEN IN NICKEL-CHROM-LEGIERUNGEN MIT UNTERSCHIEDLICHEM CHROMGEHALT]**
Wolfgang Spyra *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 230-247 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

By means of measuring hardness variations after protracted annealing, phase transformations could be determined in nickel-chromium alloys of various composition with different admixtures of titanium and aluminum. ESRO

**N69-37661#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
**INFLUENCE OF LOAD VARIATIONS ON THE CREEP PERFORMANCE OF HIGH-TEMPERATURE MATERIALS [EINFLUSS VON BELASTUNGSAENDERUNGEN AUF DAS KRIECHVERHALTEN HOCHWARMFESTER WERKSTOFFE]**
Werner Schmidt *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 247-264 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

In creep-rupture test samples overloaded at constant temperatures, the damage cannot be determined by means of assuming a linear damage accumulation, if, as in the test case, the period of overloading is short in comparison to the time until fracture of the undisturbed sample. Assuming an exponential dependence of the damage on the different stress conditions and a linear dependence on the time of overloading, measured and calculated values are found to be fairly consistent. Damage may be found in creep-rupture samples even after intermediate relieving, its extent depending as well on test temperature and relieving time. The effect of intermediate relieving on the creep behavior is thought to be due to the interrelation between recrystallization behavior and the so-called relief parameter which is computed from the time of intermediate relieving and the test temperature.
Author (ESRO)

**N69-37662#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
**INVESTIGATIONS OF DAMAGE TO CREEP SAMPLES OF X 8 CrNiNb 16 13 (ATS) AND X 15 CrMo 13 (REMANIT 1815 Mo) IN THE TERTIARY CREEP REGION [UNTERSUCHUNGEN UEBER DIE SCHAEDIGUNG VON KRIECHPROBEN AUS X 8 CrNiNb 16 13 (ATS) UND X 15 CrMo 13 (REMANIT 1815 Mo) IM TERTIAEREN KRIECHBEREICH]**
Werner Schmidt *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 264-272 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

Two steels, a martensitic Cr-Mo steel and an austenitic CrNiNb steel were investigated as to the influence of constriction and reversible changes in microstructure after stress relieving on the course of the creep diagram in the tertiary creep region. All experiments were conducted at 600°C. After eliminating the influence of the reduction of area effect the total life increased, in particular in the martensitic steel. However, creep curves after reloading did not correspond to those of the virgin material. This is due to damages which could be shown to exist by means of micro rupture tests. A further increase of total life could be obtained by annealing and after grinding of the samples. However, it seems impossible to eliminate completely the effects of plastic creep deformations.
Author (ESRO)

**N69-37663#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
**SCALE FORMATION ON VARIOUS HIGH-TEMPERATURE STEELS AND NICKEL ALLOYS BETWEEN 700 AND 1150°C IN A HUMID AIR CURRENT [ZUNDERVERHALTEN VERSCHIEDENER HOCHWARMFESTER STAEHLE UND NICKELLEGIERUNGEN ZWISCHEN 700 UND 1150°C IN STROEMENDER, FEUCHTER LUFT]**
Hans Bungardt, Hans Proisendanz, Peter Schüler, and Heinz-Jürgen Osing *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 273-285 refs In GERMAN; ENGLISH summary Presented at the Conf. on Gases in Metals of the Deut. Ges. Metallkunde and Ges. Deut. Metallhütten und Bergleute, Darmstadt, Ger. 22-23 Feb. 1968 (See N69-37641 22-17)
Avail: CFSTI

The scale formation of three types of steels (chromium steels, austenitic chromium-nickel steels containing no cobalt, steels containing cobalt) and nickel alloys in moisture-containing air currents at elevated temperatures is investigated. The oxidation proceeds in two phases, a linear initial phase, and a diffusion phase. Special phenomena (accelerated oxidation) occurring in some steel types are discussed. It is concluded that by suitably alloying high temperature steels, e.g. with yttrium or cerium, oxide layers with a high diffusion resistance or better adhesion can be formed.
Author (ESRO)

**N69-37664#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
**PROTECTIVE COATINGS AGAINST HIGH TEMPERATURE CORROSION IN AIRCRAFT TURBINE ENGINES [SCHUTZSCHICHTEN GEGEN HOCHTEMPERATURKORROSION IN FLUGTRIEBWERKEN]**
Gülenser Lehnert *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 285-290 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

Owing to increased aircraft turbine inlet temperatures and a reduction of the chromium content, turbine steels require a protective coating against high temperature corrosion consisting most advantageously of an aluminum diffusion layer. By varying the conditions during coating and annealing, coatings with different properties can be produced. Optimum protection is achieved by a surface NiAl phase.
Author (ESRO)

**N69-37665#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
**NITRIDING PERFORMANCE OF HIGH TEMPERATURE STEEL X22CrMoV121 (MTS 8) [NITRIERVERHALTEN DES HOCHWARMFESTEN STAHLES X22CrMoV121 (MTS 8)]**
Helmut Brandis *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 291-293 In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

The surface and core hardness of samples of a high-temperature steel subjected, in a tempered condition, to nitriding at 500° C for 24, 48 and 100 hours, was determined. It appeared that the nitriding depth increases linearly with the nitriding temperature, but less than linearly with the nitriding time. With an increasing nitriding temperature, the maximum hardness decreases from 1250 to 1160 Vickers hardness.
Author (ESRO)

**N69-37665#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**THERMAL CONDUCTIVITY OF SOME HIGH-TEMPERATURE STEELS AND ALLOYS AT TEMPERATURES BETWEEN 20 AND 1000°C [TEMPERATURLEITTAEHIGKEIT EINIGER HOCHWARMIESTER STAEHLE UND LEGIERUNGEN BEI TEMPERATUREN ZWISCUEN 20 UND 1000°C]**

Hans Preisendanz, Wolfgang Spyra, and Peter Schüsler *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 293-300 ref In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

The thermal conductivity, an important parameter in instationary temperature distribution problems, of 12 different high temperature steels and alloys was investigated between 20 and 1000°C. The influence of thermal conductivity, density, thermal expansion and specific heat is combined into a parameter termed thermal diffusivity. This parameter increases with rising temperature in austenitic materials, but shows a minimum in nickel alloys between 800 and 1000°C, which is due to peculiarities in the specific heat of these alloys. Comparison with pure iron and martensitic high temperature steels showed that these materials exhibit much higher thermal diffusivity parameters. Author (ESRO)

**N69-37667#** Deutsche Edelstahlwerke A.G. Krefeld (West Germany)

**DIFFERENCES IN THE TEMPERING QUALITY OF STEELS WITH A HIGH CHROMIUM CONTENT AND LOW NICKEL AND MOLYBDENUM CONTENTS CONSTANT WITHIN ANALYTICAL LIMITS [AENDERUNG DER VERGUETSBARKEIT VON HOCHCHROMHALTIGEN STAELHEN MIT GEHALTEN AN NICKEL UND MOLYBDAEN INNERHALB VORGEBEGENER ANALYSENGRENZEN]**

Helmut Brandis and Kurt Wiebking *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 300-304 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

The capability to transform into austenite of a steel with a given composition was investigated theoretically, using data from literature. Austenite is formed as long as the limit chromium content is higher than the hypothetical chromium content, which is computed from the analysis. A ferrite formation can be avoided only under special conditions. It was possible to calculate the variation of the martensite formation temperature within the analytical limits. Author (ESRO)

**N69-37668#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany)

**ON COMPUTING METHODS FOR THE PREDETERMINATION OF THE FORMATION OF CERTAIN PHASES DURING LONG TERM STRESSING OF HIGH TEMPERATURE NICKEL ALLOYS FROM THE COMPOSITION OF THE MELT [UEBER RECHENVERFAHREN ZUR VORAUSERMITTLUNG DER BILDUNG BESTIMMTER PHASEN WAEHREND DER LANGZEITBEANSPRUNCHUNG VON HOCHWARMFESTEN NICKELLEGIERUNGEN AUS DEREN SCHMELZZUSAMMENSETZUNG]**

Albert von den Steinen and Florian Schubert *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 305-313 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

During stressing high-temperature high-strength nickel-alloys the formation of certain intermetallic phases, e.g. σ-phase, can affect the creep-rupture behavior detrimentally. The present paper shows how evidences for the possibility of the precipitation of such phases can be gained from a known chemical composition of a heat by calculating the average electron vacancy number. After describing the theoretical and experimental foundations of electron vacancy theory its application to technical alloys is explained. The basic calculations are written as a computer program (Phacomp), the successful application of which and the difficulties encountered are illustrated by examples. Author (ESRO)

**N69-37669#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**CONTRIBUTION TOWARDS THE COLD FORMING OF SOME HIGH TEMPERATURE STEELS AND ALLOYS [BEITRAG ZUR KALTUMTORMUNG EINIGER HOCHWARMFESTER STAEHLE UND LEGIERUNGEN]**

Werner Küppers and Dietmar Schulz *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 313-318 ref In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

A comparison is made of the cold working properties of steels, in particular of the NiCr 20 Ti steel, with those of X 5 Cr Ni189 because more experience is available on this steel. All the steels considered, with the exception of the NiCr 20 Ti showed a strong tendency towards strain hardening so that they can be cold worked stepwise only with intermediate annealing. The limit drawing ratio can also be achieved only when using hydraulic presses and an appropriate tool geometry. If cold working proceeds stepwise as in hammering, dishing or flanging, the materials lose their formability much earlier. Author (ESRO)

**N69-37670#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**MACHINING TESTS OF HIGH TEMPERATURE MATERIALS USING CUTTING KNIVES FROM VARIOUS HIGH SPEED TOOL STEELS [ZERSPANUNGSVERSUCHE AN HOCHWARMFESTEN WERKSTOFFEN MIT DREHMEISSELN AUS VERSCHIEDENEN SCHNELLARBEITSSTAEHLEN]**

Hans Hermann Weigand and Edmund Haberling *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 318-328 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

Tests were made on the suitability of different high-speed steels for turning high-temperature alloys with uninterrupted and interrupted cuts. In these investigations the influence of speed and feed, tool geometry and heat-treatment of the tools on the tool wear was determined. Among the tested high-speed steels the types S 10-4-3-10 (Komo 310) and SC 6-5-2-5 (Komo 205) with higher carbon content can be used in the most cases with success. For interrupted cuts it may be advantageous to use tools hardened at lower temperatures to give greater toughness. For practical use the optimum tools and cutting conditions are tabulated. Author (ESRO)

**N69-37671#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**HIGH TEMPERATURE ETCHING OF HIGH TEMPERATURE HIGH STRENGTH STEELS [ANLASSAETZUNG HOCHWARMFESTER LEGIERUNGEN]**

Elisabeth Horn *In its* DEW Tech. Rept., Vol. 9, No. 2 1969 p 329-334 refs In GERMAN; ENGLISH summary (See N69-37641 22-17)

Avail: CFSTI

High temperature etching is a relatively simple process used to reveal phase microstructure in high alloyed steels. The principle and procedures of this method are described and examples are used to show which phases in high temperature steels and alloys can be distinguished by means of color differences. Some etched structures of ferrous and nonferrous chromium-nickel alloys are used to show occasional variations in the alloy composition in the matrix, which indicate non-equilibrium conditions during the formation of precipitations. Author (ESRO)

**N69-37672#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).

**APPLICATION OF HIGH-TEMPERATURE MATERIALS IN**

**AIRCRAFT JET ENGINES [DIE ANWENDUNG HOCHWARMFESTER WERKSTOFFE IM FLUGTRIEBWERK]**
Dieter Hannen and Hans Mathesius *In its* DEW Tech. Rept., Vol. 9, No. 2, 1969, p 335-343, refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

This paper discusses special steels, cobalt- and nickel- alloys which are used in the production of the most recent types of jet engines. The principal properties of these high-temperature steels and alloys are briefly described and it is indicated in which part of the engine for which components, facilitates orientation. For application in compressor production, the standard 12%-Cr-steels were modified by additions of molybdenum, nickel, columbium-tantalu, and vanadium to improve their high-temperature strength. Cobalt alloys are distinguished by their high scaling resistance, their low susceptibility to thermal shock and their excellent welding properties. Apart from specific alloying techniques, two special measures are taken to make operating with higher gas-inlet temperatures possible and increase the engine efficiency accordingly: 1) Surface protection by diffusion of metals into the component surface. 2) Air-cooling which reduces the material temperature of a turbine blade by as much as 250°C. Apart from continuing work on superalloys and the related technologies, research and development specialists will in future also concentrate their activities on fiber-reinforced and dispersion-hardening compound materials.
Author (ESRO)

**N69-37673#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
**APPLICATION OF TEMPERATURE AND HIGH-TEMPERATURE RESISTANT STEELS AND ALLOYS IN STEAM AND GAS TURBINE DESIGN [EINSATZ VON WARMFESTEN UND HOCHWARMFESTEN STAEHLEN UND LEGIERUNGEN IM DAMPF- UND GASTURBINENBAU]**
Dieter Hannen and Peter Roth *In its* DEW Tech. Rept., Vol. 9, No. 2, 1969, p 343-352, refs In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

The ever increasing demand for electric energy has greatly promoted the development of steam and gas turbines. Higher temperatures, increased pressures and larger turbines called for new steels and alloys able to withstand the new stresses entailed. For steam turbines using steam inlet temperatures of up to 560°C the standard 12% Cr steels were improved by additions of molybdenum and vanadium with the result of better creep rupture properties. For temperatures higher than 600°C high-temperature austenitic steels were developed with 16% Cr and 13% Ni or 16% Ni plus molybdenum, tungsten, columbium + tantalum and boron. The low pressure stages will be equipped with increasingly larger blades and will therefore require new corrosion resisting steels with 0.2-limits of over 80 kp/mm$^2$ because common 12% chromium steels, sometimes with additions of molybdenum and vanadium, do not give the required mechanical properties. In view of the increasing inlet temperatures in gas turbine engines, nickel and cobalt alloys are selected. In stationary gas turbines, the increase of high-temperature corrosion resistance is more important than obtaining high creep rupture strength. The materials currently used, their chemical composition and mechanical properties are displayed in tables and diagrams.
Author (ESRO)

**N69-37674#** Deutsche Edelstahlwerke A.G., Krefeld (West Germany).
**SAFETY REQUIREMENTS FOR HIGH-TEMPERATURE DESIGN [UEBER DIE SICHERHEIT HEISSER KONSTRUKTIONEN]**
Paul Gernhardt *In its* DEW Tech. Rept., Vol. 9, No. 2, 1969, p 353-359, ref In GERMAN; ENGLISH summary (See N69-37641 22-17)
Avail: CFSTI

In tube furnaces used in hydrogen production plant tubing is subjected to extremely high stresses. As it is difficult to obtain creep rupture values for a service life of 100,00 hours, design for a 50,000 hour life is more appropriate. In such plant, the design safety factor is a time variable, so that it is recommended to use initial safety factors in a way that after the planned lifetime the safety factors becomes unity. Up to that moment, creep ruptures are unlikely to occur. Afterwards, creep rupture occurrences are ascribed to actual stress increases due interfacial effects.
Author (ESRO)

**N69-37719#** Oak Ridge National Lab., Tenn.
**HEAVY-SECTION STEEL TECHNOLOGY PROGRAM Semiannual Progress Report, Period Ending 31 Aug. 1969**
Apr. 1969, 124 p refs
(Contract W-7405-ENG-26)
(ORNL-4377) Avail: CFSTI

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1. PROGRAM ADMINISTRATION AND PROCUREMENT, p 1-12, refs (See N69-37720 22-32)
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4. PRESSURE VESSEL INVESTIGATIONS, p 97-109, refs (See N69-37723 22-32)

**N69-37721#** Oak Ridge National Lab., Tenn.
**INVESTIGATION OF UNIRRADIATED MATERIALS**
*In its* Heavy-Sect. Steel Technol. Program, Apr. 1969, p 13-54, refs (See N69-37719 22-17)
Avail: CFSTI

Results obtained in programs devoted to unirradiated specimens in the areas of inspection, characterization, variability testing, transition temperature testing, fracture mechanics testing, and fatigue-crack propagation are summarized.
NSA

**N69-37722#** Oak Ridge National Lab., Tenn.
**INVESTIGATIONS OF IRRADIATED MATERIALS**
*In its* Heavy-Sect. Steel Technol. Program, Apr. 1969, p 55-96, refs (See N69-37719 22-17)
Avail: CFSTI

Data resulting from preirradiation testing of 12-in.-thick plates of ASTM A533B steel are presented tabularly and graphically. Data are included on tensile properties, impact properties, and fracture. Initial data resulting from radiation testing of similar steel specimens are also included on impact properties, tensile properties, and fracture.
NSA

**N69-37750#** Aerospace Corp., El Segundo, Calif. Lab. Operations.
**ALLOY COMPATIBILITY WITH SEVERAL CLEANING AGENTS, 1 SEPTEMBER 1968 - 31 JANUARY 1969**
Dennis L. Dull, Louis Raymond, and Raymond J. Usell 29 May 1969 28 p refs
(Contract F04701-68-C-0200)
(AD-689746; TR-0200(4250-10)-9; SAMSO-TR-69-178) Avail: CFSTI CSCL 11/6

This investigation was conducted to screen the compatibility of four common aerospace structural materials with three common cleaning agent environments in order to identify the problem sources and suggest methods to avoid these problems.
Author (TAB)

**N69-37755#** Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
**THEORY ON DISPERSION TOUGHENING OF BRITTLE MATERIALS**
F. F. Lange 29 May 1969 25 p refs
(Contract N00014-68-C-0323)
(AD-688947; TR-2) Avail: CFSTI CSCL 11/6

Observations are presented showing that a crack front increases its length when it intersects with two or more inhomogeneities in

a brittle material. These observations are presented for both cleavage and conchoidal types of fracture. Based on these observations an expression for the fracture energy is obtained. Author (TAB)

**N69-37837#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**NONMAGNETIC AGE-HARDENABLE ALLOY**
D. I. Gabrielyan et al Mar. 1969 5 p Transl. into ENGLISH from Russian Patent No. 206101 (Appl. no. 1094522/22-1, 25 Jul. 1966) 1 p
(AD-689716; FTD-HT-23-1218-68) Avail: CFSTI CSCL 11/6

The author certificate introduces a nonmagnetic chromium-nickel base dispersion-hardenable alloy. To obtain higher strength and elasticity, the alloy contains 45.5-50.0 percent Cr, 1.0-4.0 percent Al, and the remainder Ni. TAB

**N69-37873#** Aerospace Research Labs., Wright-Patterson AFB, Ohio. Metallurgy and Ceramics Research Lab.
**SURFACE ENRICHMENT IN Fe-Ni BINARY ALLOYS IN SULFURIC ACID AT 25 DEG C**
Dale O. Condit Mar. 1969 67 p refs
(AD-689823; ARL-69-0044) Avail: CFSTI CSCL 11/6

The dissolution characteristics of high purity Fe-Ni Binary alloys were investigated in H2SO4 at 25C. The specimens were dissolved at constant potential atomic absorption analysis was used to analyze the solutions to determine the Fe and Ni concentrations and their respective rates of dissolution. The dissolution behavior of the alloys was plotted as a logarithmic function of the form C = AT(N) where C was the concentration of Fe or Ni, T was time, N was the slope of the logarithmic curve, and A was a constant. The slopes fN for all alloys was approximately 1.0, indicating a linear rate of dissolution. Using this approximation to determine intrinsic zero-order rate constants and (Fe/Ni) ratios in solution, enrichment of nickel on the surface of alloys containing 5 to 50 atomic per cent nickel could be expected at high dissolution potentials of 0 MV(SHE). Anodic polarization curves were determined from weight changes, which correlated well with integrated currents and total ions in solution. Both the corrosion currents and the anodic tafel slopes changed significantly from the BCC 20 per cent nickel alloy to the FCC 45 per cent nickel alloy. This indicates that these characteristics may be a function of alloy structure. Author (TAB)

**N69-37895#** Reactor Centrum Nederland, Petten.
**POSITRON ANNIHILATION IN METALS: A CONTRIBUTION TO THE ANALYSIS OF ANGULAR CORRELATION MEASUREMENTS, WITH AN APPLICATION TO COPPER**
P. E. Mijnarends (Ph.D. Thesis) Aug. 1969 109 p refs
(RCN-108) Avail: CFSTI

A new method of analysis is presented for reconstructing the momentum distribution of the radiation emitted by positrons annihilating in crystalline solids. This technique makes it possible to obtain information concerning the momentum distribution of the electrons. A theoretical treatment of the method is followed by a discussion of the effects of various geometrical corrections. New angular correlation measurements on copper are reported. Application of the method to these measurements yields a Fermi surface in good quantitative agreement with results obtained by other methods in the (100) directions, while there is a 5% difference in the (110) directions. Possible reasons for the observed discrepancy are discussed. Author (ESRO)

**N69-37926#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
**ELECTRON MICROSCOPE STUDY OF VACANCY CLUSTERS PRODUCED BY QUENCHING IN MAGNESIUM [ETUDE PAR MICROSCOPE ELECTRONIQUE DES AMAS DE LACUNES CREES PAR TREMPE DANS LE MAGNESIUM]**
Viviane Levy, Jacqueline Espinasse, Claude Mairy, and Jacques Hillairet May 1969 21 p refs In FRENCH; ENGLISH summary
(CEA-R-3784) Avail: CFSTI

Vacancy clutering in quenched magnesium has been studied by transmission electron microscopy. The nature of the vacancy loops observed seems to depend essentially on the impurity content of the metal; this effect can attribute to a variation of the stacking fault energy of magnesium due to impurities. Author (ESRO)

**N69-37932#** New York Univ., N.Y. Research Div.
**DEVELOPMENT OF TOUGH, HIGH-STRENGTH ALPHA-BETA TITANIUM-BASE ALLOYS AT 240000-260000 psi YIELD STRENGTH LEVEL 2 Final Report, 1 Jan. 1966–30 Sep. 1968**
P. A. Farrar and H. Margolin Dec. 1968 167 p refs
(Contract DA-19-066-AMC-319(x))
(AD-689471; AMMRC-CR-67-01(F)) Avail: CFSTI CSCL 11/6

The report discusses an alloy development program undertaken to produce titanium alloys with superior tensile and duetile properties. TAB

**N69-37959#** Bureau of Mines, Reno, Nev. Metallurgy Research Center.
**PREPARATION OF RARE-EARTH AND YTTRIUM METALS BY ELECTRODEPOSITION AND VACUUM DISTILLATION OF ALLOYS**
E. Dward Morrice, J. E. Murphy, and M. M. Wong Oct. 1969 14 p refs
(BM-RI-7308) Avail: Issuing Activity

Gadolinium, dysprosium, and yttrium are difficult to electrowin as high-purity liquid metals because of their high melting points (>1,300°C). Samarium metal is difficult to prepare directly by electrolysis because the metal reacts with the electrolyte. In this Bureau of Mines study, the rare-earth metal was electrodeposited on a solid manganese, chromium, or iron cathode to form a low-melting alloy. The alloy was then vacuum distilled to separate the rare-earth metal from the ferrous metal. A typical samarium metal product, obtained as the distillate from vacuum distillation of a samarium-iron alloy, contained 150 ppm oxygen, 80 ppm carbon, and 50 ppm iron as impurities. Gadolinium metal, obtained as a residue from the distillation of a gadolinium-chromium alloy, contained 300 ppm oxygen, 200 ppm carbon, and 100 ppm chromium. Author

**N69-37986#** Los Alamos Scientific Lab., N. Mex.
**POWDER EXTRUSION OF TUNGSTEN TUBING**
W. C. Erickson and C. A. Javorsky 7 May 1968 19 p refs
(Contract W-7405-ENG-36)
(LA-4099) Avail: CFSTI

A development program for the fabrication of refractory metal tubing by powder extrusion has been underway for several years. Current development work shows that microcracking can be eliminated by using a minimum amount of binder and a slow low-temperature cure. Final theoretical densities of 97% were obtained on sintered tubing ranging in wall thickness from 0.025 to 0.110 in. Author (NSA)

**N69-38074*#** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
**DISPERSION-STRENGTHENED NICKEL PRODUCED FROM ULTRAFINE COMMINUTED POWDERS**
Max Quentinetz and John W. Weeton Washington Oct. 1969 28 p refs
(NASA-TN-D-5421) Avail: CFSTI CSCL 11F

An investigation conducted to produce dispersion strengthened products by a mechanical comminution and blending approach was combined with a study of the effect of varying degrees of thermomechanical processing on the strength of the materials produced. Dispersion strengthened nickel products comparable or

better in strength to the best available commercial products were produced. While the products generally increased in strength with increased amounts of thermomechanical processing, changes in composition of the composite were shown to affect the response of the material to the working process. Author

**N69-38115#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**EQUIPMENT FOR ELECTRON-BEAM WELDING**
Mar. 1969 16 p Transl. into ENGLISH from the Russian
(AD-689818; FTD-MT-24-423-68) Avail: CFSTI CSCL 11/6

The report discusses a recently developed method for welding metals using a powerful electron beam in a vacuum known as electron-beam welding. This type of welding is effective during connection of parts constructed from refractory and chemically active metals: tungsten, molybdenum, tantalum, niobium and others. Author (TAB)

**N69-38158#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**EFFECT OF CRYSTAL LATTICE TYPE AND DISPERSION OF STRUCTURAL COMPONENTS OF ALLOYS ON RESISTANCE TO FAILURE IN ABRASIVE WEAR**
V. V. Popov et al. 29 Nov. 1968 10 p refs Transl. into ENGLISH from Fiz.-Khim. Mekhan. Materialov. Akad. Nauk Ukr. SSR (Kiev), v. 3, no. 4, 1967 p 432–435
(AD-689819; FTD-HT-23-1032-68) Avail: CFSTI CSCL 11/6

Specimens of steel and 30KH15M3 cast iron were subjected (after different heat treatments) to abrasive wear under industrial conditions of refractory-power compaction to establish the effect of structure on wear resistance. Author (TAB)

**N69-38232*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**STRESS CORROSION CRACKING EVALUATION OF SEVERAL PRECIPITATION HARDENING STAINLESS STEELS**
T. S. Humphries and E. E. Nelson 12 Sep. 1969 25 p refs
(NASA-TM-X-53910) Avail: CFSTI CSCL 11F

The stress corrosion cracking resistance of precipitation-hardening stainless steels PH 13-8 Mo, PH 14-8 Mo, 15-5 PH, PH 15-7 Mo, 17-4 PH, 17-7 PH, A-286, Almar 362, AM-350, and Unitemp 212 are presented. Three types of specimens (round tensile, flat tensile, and C-rings) were employed and were subjected to alternate immersion in a 3.5% salt solution. The results indicate that under these test conditions, PH 13-8 Mo, PH 14-8 Mo, 15-5 PH, 17-4 PH, A-286, Almar 362, and Unitemp 212 staninless steels are highly resistant to stress corrosion cracking in practically all forms and heat treatment conditions. Alloys PH 15-7 Mo and 17-7 PH are susceptible to stress corrosion cracking in nearly all heat treatment conditions except CH 900, and AM-350 is susceptible in condition SCT 850 but resistant to stress corrosion cracking in condition SCT 1000. Author

**N69-38246#** California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
**STRUCTURE AND MAGNETIC PROPERTIES OF RAPIDLY QUENCHED SM-TYPE ALLOYS**
J. D. Speight May 1969 27 p refs
(Contract AT(04-3)-221)
(CALT-221-67) Avail: CFSTI

The results of rapid quenching experiments on Sm-type alloys in the gadolinium-lanthanum, gadolinium-cerium, gadolinium-praseodymium and gadolinium-neodymium binary systems are reported. The alloys were examined to study the effect of rapid quenching on the Sm-type crystal structure and the effect of quenching on the magnetic properties of the alloys. Author (NSA)

**N69-38306#** General Electric Co., Cincinnati, Ohio. Missile and Space Div.
**VOIDS IN IRRADIATED TUNGSTEN AND MOLYBDENUM**
R. C. Ran, R. L. Ladd, and J. Moteff [1969] 9 p refs
(Contract AT(40-1)-2847)
(GEMP-682) Avail: CFSTI

Three-dimensional cavities, or voids, were generated when body-centered cubic tungsten and molybdenum specimens were irradiated to fast neutron fluences of 1.3 to 1.9 $\times 10^{20}$ n/cm$^2$. These vacancy-filled voids were observed only when the irradiation temperatures were at or above 0.31 $T_m$ ($T_m$ is the absolute melting point) for the metal. The void size and volume fraction in both tungsten and molybdenum increased with increasing irradiation temperature. At comparable homologous irradiation temperatures tungsten contained smaller voids and a lower percentage of void volume than molybdenum. These relatively stable voids act as barriers to dislocation motion and thus could affect the high temperature strength properties of a material. NSA

**N69-38319#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**SOME FUNDAMENTAL IDEAS IN TOPOLOGY AND THEIR APPLICATION TO PROBLEMS IN METALLURGY**
Lida K. Barrett and C. S. Yust Jun. 1969 55 p refs
(Contract W-7405-ENG-26)
(ORNL-4411) Avail: CFSTI

The topological ideas and results that have been used by metallurgists, together with several results not previously presented in the metallurgical literature, are developed in a systematic manner. Based on this presentation, a review is given of the use of topology in metallurgy. The additional topology that is introduced is used to establish interrelationships among the results of several papers and to clarify the mathematical treatment. The new ideas introduced include the Alexander Duality Theorem, the Euler–Poincare formula, and the concept of deformation retract. The Euler–Poincare formula is used to relate results of F. N. Rhines to those of J. W. Cahn. The topological model of sintering of F. N. Rhines is discussed as a deformation retract. Deformation retract properties, together with the Alexander Duality Theorem, are used to mathematically validate a formula of Kronsbein, Buteau and DeHoff and to establish in a new mathematical manner a formula of Kronsbein and Steele. Author (NSA)

**N69-38320*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**TENSILE PROPERTIES OF UNALLOYED TANTALUM AT TEMPERATURES UP TO 1350 DEG F (1000 K)**
Adolph C. Spagnuolo and Phillip L. Stone Sep. 1969 9 p refs
(NASA-TM-X-52670) Avail: CFSTI CSCL 11F

Unalloyed tantalum tensile specimens of various shapes and different heats were tested at various elevated temperatures (450° to 1350° F (505 to 1005°K), at a vacuum level of 4.1 $\times$ $10^{-8}$ torr (5.5 $\times$ $10^{-4}$ N/M$^2$) or less. Much scattering was observed in the ultimate stress, from 15,500 to 28,000 psi (10.5 $\times$ $10^7$ to 19.3 $\times$ $10^7$ N/m$^2$), among the different shapes tested at the same temperature, 1350°F (1005°K). Correlation, however, was good among specimens machined from the same heat, 20,200 to 23,400 psi for the tube specimens. Author

**N69-38334#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**FABRICATION OF PROMETHIUM SESQUIOXIDE HEAT SOURCES BY HIGH ENERGY RATE FORMING**
N. C. Davis and D. W. Brite May 1969 44 p refs
(Contract AT(45-1)-1830)
(BNWL-1041) Avail: CFSTI

High energy rate forming (HERF) was used as a fabrication method for the densification of encapsulated promethium sesquioxide. The development and characteristics of the HERF process are presented. Simulated radioisotope materials were used

to develop capability for controlled dimensional integrity, and promethium sesquioxide has been densified in various metal claddings for compatibility testing. Author (NSA)

**N69-38339#** Pennsylvania State Univ., University Park. Dept. of Materials Science.
**BIBLIOGRAPHY OF THERMAL EXPANSION IN INTERMETALLIC COMPOUNDS**
D. J. Michel and E. Ryba 1 Jun. 1969 10 p refs
(Contract AT(30-1)-3560)
(NYO-3560-17) Avail: CFSTI

Expansion coefficients for 92 intermetallic compounds are listed. The compounds are arranged alphabetically giving structure type, if known; temperature range over which data are available; the expansion coefficients; and the reference. Author (NSA)

**N69-38344#** Radio Corp. of America, Princeton, N.J.
**IMPROVED COMPATIBLE MATERIALS FOR THERMOELECTRIC POWER GENERATION**
J. P. Dismukes, I. Kudman, and H. I. Moss Apr. 1969 32 p refs
(Contract AT(30-1)-3386)
(NYO-3886-3) Avail: CFSTI

An examination of the hot-pressing procedure of n-type $Pb_{.95}Ge_{.05}Te$ alloys has been undertaken. This has included the effects of the temperature and duration of both hydrogen and vacuum annealing of the powders, and the effects of stoichiometry (Pb/Te ratio) and composition (Pb/Ge ratio) of the starting material. It was found that hydrogen annealing at a temperature exceeding 600°C is necessary to ensure the removal of oxygen contamination. Long vacuum anneals at elevated temperatures are to be avoided, presumably because of loss of dopant and/or one of the constituents. The Pb/Ge ratio markedly affects both the solubility of the n-type dopant, and at constant doping affects the resistivity. The problems previously observed with hot-pressed material have been eliminated. Encouraging life-test behavior has already been observed, and further life-testing is continuing. Apparatus for thermocouple efficiency measurements andingradient testing has been constructed. Author (NSA)

**N69-38387#** Southwest Research Inst., San Antonio, Tex.
**NONDESTRUCTIVE EVALUATION OF METAL FATIGUE**
P. N. Kusenberger, P. H. Francis, B. E. Leonard, and J. R. Barton Apr. 1969 73 p refs
(Contract AF 49(638)-1502)
(AD-688892; AFOSR-69-1429TR) Avail: CFSTI CSCL 11/6

Investigations of nondestructive inspection techniques for the early detection and evaluation of fatigue damage in metals have been extended. Photographs of the fatigue evaluation apparatus are shown, and brief descriptions of the ultrasonic, magnetic perturbation, and electric current injection nondestructive techniques are presented. Results obtained using ultrasonic and electric current instrumentations to monitor a stress-cycled Ti-6Al-4V specimen are presented and discussed. Ultrasonic and magnetic perturbation instrumentations were used to monitor many stress-cycled AISI 4340 steel specimens. Magnetic data were accumulated using a very small Hall effect probe and new signal response characteristics were obtained. Reproductions of many ultrasonic and magnetic records are shown; surface photomicrographs showing fatigue microcracks are included. Data are presented that show the lives of AISI 4340 steel specimens can be significantly extended by the local removal of fatigue microcracks. Author (TAB)

**N69-38388#** Los Alamos Scientific Lab., N.Mex.
**KIRKENDALL EFFECT IN SINTERED REFRACTORY METAL ALLOYS**
W. H. Lenz and R. E. Riley 20 Feb. 1969 18 p refs
(Contract W-7405-ENG-36)
(LA-4153-MS) Avail: CFSTI

The evaluation and treatment of tungsten, tantalum, molybdenum, and rhenium powders as applied to this work are reviewed. Inefficient sintering of certain elemental power combinations is ascribed to the Kirkendall effect, related to typical results when sintering mixtures of elemental tungsten, tantalum, molybdenum, and rhenium powders. Experiments involving the sintering of W–Mo–Re alloys made from elemental and prealloyed powders are presented to show the effect of power characteristics as well as a wide range of sintering temperature and cycles. The results are related to physical and chemical composition of the ternary mixtures, and to sintering cycles, to reveal the conditions which minimize the Kirkendall effect. Author (NSA)

**N69-38401#** United Kingdom Atomic Energy Authority, Culcheth (England). Reactor Group.
**THE STRENGTH OF Zr-2 AND 1/2 PERCENT Nb ALLOY IN THE ANNEALED AND COLD-WORKED CONDITION**
R. A. Murgatroyd and J. Winton 22 Oct. 1968 19 p refs
Submitted for publication
(TRG-Rept-1786; Conf-670909-10; HWR-FEMWG/P-68)355)
Avail: AEC Depository Libraries

The development of cold-worked Zr-2-1/2% Nb for use as pressure tube material is described. The mechanical properties of cold-worked Zr–2-1/2% Nb are given and a comparison with cold-worked Zircaloy-2 is made, which shows that the strength of Zr–2-1/2% Nb both at 20 and 300°C is the greater by 10 to 20,000 psi. Irradiation at 300°C to doses of $5.2 \times 10^{24} n/cm^2$ (Ni) increased the strength of both Zr–2-1/2% Nb and Zircaloy-2 by about 30,000 psi. Creep data for pressure tube material are given for 300°C, which fit the equation $\epsilon = 1.45 \times 10^{-6} \sigma^{2.5} t^{1/3}$. X-ray and transmission electron microscopy results are presented which show that the observed strengthening in Zr–2-1/2% Nb may be attributed to Nb and $O_2$ in solid solution, to precipitation in the $\alpha$–Zr phase during cooling, and to cold work. Aging at 400°C and below causes further precipitation, which explains the strengthening observed after autoclaving, while aging above 400°C causes rapid over-aging and softening. Author (NSA)

**N69-38409#** Bureau of Mines, Albany, Oreg. Albany Metallurgy Research Center.
**BUREAU OF MINES METALLURGICAL REPORT Quarterly Progress Report, 1 Jul.–31 Sep. 1968**
30 Sep. 1968 30 p refs
(Contract AT(11-1)-599)
(USBM-RC-1355; QPR-40) Avail: CFSTI

Investigations of the binary systems V–O, V–N, and V–C were continued. A process investigated to prepare $Na_4FeO_3$ was not successful. Experiments to prepare $V_2N$ led to the establishment of a synthesis procedure. Progress on the purification of tungsten, vanadium, and zirconium is reported. The refining of vanadium scrap was concluded. Testing of all scrap samples was conducted and the results are tabulated. NSA

**N69-38484#** Atomics International, Canoga Park, Calif. Liquid Metal Engineering Center.
**CORROSION OF TYPE 18-18-2 STAINLESS STEEL IN 1200 DEG F STATIC SODIUM**
W. T. Lee 15 May 1969 35 p refs
(Contract AT(04-3)-700)
(LMEC-69-11) Avail: CFSTI

Coupons of Type 18-18-2 stainless steel were immersed in 1200°F static sodium for periods up to 5060 hr. In addition, 12 Type 304 stainless steel tabs were simultaneously exposed for comparison. The average oxygen impurity in the sodium was about 30 ppM. The results of these preliminary tests show that Type 18-18-2 stainless steel is sufficiently corrosion-resistant in 1200°F sodium to warrant more thorough evaluation. Author (NSA)

**N69-38495#** Aerojet-General Corp., San Ramon, Calif. Nuclear Div.

**ALKALI METALS EVALUATION PROGRAM Quarterly Progress Report, 1 Apr. –30 Jun. 1968**

P. Y. Achaner Sep. 1968 18 p refs

(Contract AT(04-3)-368)

(AGN-8296) Avail: CFSTI

Efforts devoted to determination of thermodynamic and transport properties of rubidium and cesium have continued. Experimental data on the vapor thermal conductivity for rubidium are tabulated. The Prandtl numbers for cesium and rubidium vapors are presented graphically. Experiments to determine the thermal conductivity of K vapor were performed at 1000 to 1500°F. The liquid viscosity and liquid specific heat of lithium and sodium, and the vapor pressure of lithium were determined. Research on the surface tension, contact angle, and liquid thermal conductivity of Li and Na has been initiated. NSA

**N69-38497#** Aerojet-General Corp., San Ramon, Calif. Nuclear Div.

**ALKALI METALS EVALUATION PROGRAM Quarterly Progress Report, 1 Jul. –30 Sep. 1968**

P. Y. Achener Nov. 1968 21 p refs

(Contract AT(04-3)-368)

(AGN-8305) Avail: CFSTI

The refractory metal holder of the vapor viscosity apparatus was completed and is being tested. The determination of the vapor thermal conductivity and Prandtl number of potassium was completed. Tentative results of the surface tension of sodium with 40 to 190 ppM oxygen are given. The apparatus for the determination of the thermal conductivity of liquid lithium and sodium at 2200 to 2500°F was fabricated and assembled. The determination of the thermal conductivity of liquid sodium was begun. NSA

**N69-38539#** Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

**SECONDARY ELECTRON EMISSION OF METAL FOILS IN THE ENERGY RANGE OF 1.5-7 GEV**

E. Raquet Mar. 1969 18 p refs

(DESY-69/12) Avail: AEC Depository Libraries

The secondary emission properties of single metal foils were investigated for the purpose of designing a secondary emission monitor with a minimum scattering length. The more basic behavior of the secondary emission is considered. For an understanding of the emission from thin metal foils two results seem to be important. The ratio of the secondary emission from the beam entrance surface of the foil to that from the beam exit surface is roughly 2:1. In agreement with a previous theoretical treatment the emission from the entrance surface depends on the primary energy, while the emission from the exit surface is independent. Some applications are briefly described. Author (NSA)

**N69-38557#** Philco-Ford Corp., Newport Beach, Calif.

**DEVELOPMENT OF SHEAR SPINNING TECHNOLOGY FOR BERYLLIUM**

Richard P. Semke and John L. Ledman (Sandia Corp., Albuquerque, N.Mex.) Apr. 1969 34 p refs Presented at the 10th Struct. Structural Dyn. and Mater. Conf., New Orleans, La.

(SC-R-69-1233; Conf-690415-1) Avail: CFSTI

The extent to which beryllium products can be hot formed into conical shapes by sine law shear spinning was determined. With successful process development, economies in time and material are realized; furthermore, with process optimization, enhancement of mechanical properties through thermomechanical processing may be realized. Both wrought ingot plate and vacuum hot pressed block material were included in the study. The materials are characterized with respect to source, production practice, chemistry, and microstructure. Elevated temperature bend, tensile, and hardness tests were used to select optimum forming conditions. In the process development, required reductions, rates of deformation, lubrication, effects of tool geometries, and inprocess heat treatments were studied. Particular care is used to control process variables, with workpiece temperature control most critical. Results of the study indicate that Be can be shear formed under proper process controls. Author (NSA)

**N69-38558#** Defence Standards Labs., Maribyrnong (Australia).

**NOTCH TOUGHNESS OF MILD STEEL SUBMERGED ARC WELDS**

Peter Charles Hughes Mar. 1969 25 p refs Ann. Assembly of the Intern. Inst. of Welding, Kyoto, 1969

(NP-17940; Rept-334; IIW-X-512-69) Avail: AEC Depository Libraries

The notch toughness and metallurgical quality of mild steel submerged arc weld metal were evaluated. Welds are made using conventional acid fluxes and a number of experimental basic fluxes. The Charpy test results demonstrate that significant increases in ductile fracture energy and decreases in transition temperature can be obtained by using basic fluxes. The extent of these improvements varies with the weld metal deoxidation practice used and the metallurgical reasons for this behavior are discussed. Author (NSA)

**N69-38571#** Bureau of Mines, Rolla, Mo. Metallurgy Research Center.

**EFFECT OF LOWERING THE TIN CONTENT OF SECONDARY RED BRASS**

L. W. Higley, J. L. Holman, E. R. Cole, and R. Kenworthy Oct. 1969 13 p refs

(TRF-18) Avail: Issuing Activity

Laboratory melts of the important secondary casting alloy, leaded red brass (85 percent Cu-5 Sn-5 Pb-5 Zn), were made in which the tin content was reduced from 5 percent to 3 and 1 percent, with increased copper or zinc to offset the reduction in tin. The mechanical properties and machinability characteristics of the resultant alloys were compared with minimum properties for leaded red brass, and with typical properties for leaded red brass. Results indicate that much of the primary tin added to achieve composition in leaded red brass could be eliminated without significantly affecting strength, ductility, or machinability. Author

**N69-38576#** Technische Hochschule Munchen (West Germany). Institut fuer Metallurgie und Metallkunde.

**TRANSFORMATION CHARACTERISTICS OF A Zr-4 WT. PERCENT V ALLOY**

W. Lehmann Dec. 1968 35 p refs In GERMAN

(BMwF-FBK-68-61) Avail: AEC Depository Libraries

The $\beta \rightleftarrows \alpha$-transformation in the zirconium-vanadium system was studied using hardness measurements, metallographic and x-ray diffraction techniques. It was found that the martensitic transformation is suppressed when the amount of vanadium exceeds the critical level of about 3 wt %. When the alloy content is higher, the $\beta$-phase cannot be quenched completely and $\beta$ transforms partially into the athermal $\omega'$-phase. A complete retention of $\beta$ is not possible. The $\omega_s$-temperature was found between 100 and 200°C, whereas the metastable $\omega'$-phase decomposes during subsequent aging into $\alpha + ZrV_2$ and the retained $\beta$ transforms primarily into the aged $\omega$-phase. A direct transformation of $\beta$ and $\alpha$ was found by quenching to temperatures above 530°C. Two TTT-charts show the various transformation steps. Author (NSA)

**N69-38580#** Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.

**RADIATION EFFECTS IN ORDERED Fe-Al ALLOYS: MOESSBAUER EXPERIMENTS FOLLOWING NEUTRON CAPTURE**

Wolfram G. Berger and Gordon Czjzek Feb. 1969 10 p refs Submitted for publication

(KFK-932; Conf-690910-9) Avail: AEC Depository Libraries

Moessbauer effect with $^{57}Fe$ following neutron capture in $^{56}Fe$ has been investigated in Fe–Al alloys in the concentration range from about 26 to 52 at. % Al. In ordered alloys of CsCl structure we observed line shifts due to recoil effects following neutron capture. In a $Fe_3Al$ alloy of $DO_3$ type order additional changes in the internal magnetic fields have been found. Both effects are discussed in terms of possible final positions for the primary recoiled iron atmo in the lattice. Author (NSA)

**N69-36584#** Electricity Council Research Center, Capenhurst (England).
**THE INDUSTRIAL APPLICATIONS OF SUPERPLASTICITY: AN ACCOUNT OF AN ECRC SYMPOSIUM**
R. H. Johnson Mar. 1969 44 p *Its* Job No. 042
(ECRC/M135) Avail: CFSTI

Summaries of seven presentations at this one-day symposium are presented which cover the following: (1) a review of the most commonly used superplastic metals and alloys which briefly deals with their grain structure, stress behavior, and temperature characteristics; (2)the utilization potential of superplasticity in sheet-metal pressing and drawing; (3)improvements in tensile impact, and fatigue strengths at room temperature of a stainless steel sufficiently fine-grained to be superplastic at elevated temperatures; (4) processes and equipment for vacuum forming, blow moulding, and spin casting in the plastic industry; (5) steel pressing and considerations of using a Zn-Al superplastic alloy in car body construction; (6) pressure forming of the eutectic Pb-Sn alloy as used in tube extrusion; and (7) a method and a rig for die-less drawing of heated superplastic metal. K.W.

# 18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

**N69-37268#** Army Materials and Mechanics Research Center, Watertown, Mass. Ceramics Research Lab.
**RECENT DEVELOPMENTS IN PYROLYTIC GRAPHITE**
R. Nathan Katz and Charles P. Gazzara Feb. 1969 19 p refs Presented at AMMRC Seminar on Structural Ceram. and Design with Brittle Mater, Chicago, Mar. 1968
(AD-688074; AMMRC-MS-69-01) Avail: CFSTI CSCL 11/2

A study of the fine microstructure of boronated pyrolytic graphite was made utilizing optical and electron microscopy and X-ray diffraction techniques. The influence of boron content on the laminar structure, the lattice parameter, the lattice strain, the particle size, and the flexural strength of pyrolytic graphite were studied. Significant changes in the behavior of all investigated parameters were observed in the 0.50 to 0.75 percent boron range. A mechanism relating these changes to the appearance of a B4C deposit is hypothesized. In addition, the effects of post-deposition thermal treatment on the mechanical properties of unboronated pyrolytic graphite are discussed. Some general remarks concerning similarities in structure of pyrolytic materials are presented. Author (TAB)

**N69-37299*#** Boeing Co., Seattle, Wash. Missile and Information Systems Div.
**DEMONSTRATION OF MANUFACTURING TECHNIQUES FOR APPLICATION OF HIGH PERFORMANCE CRYOGENIC INSULATION Final Report, 1 May – 11 Sep. 1968**
11 Sep. 1968 53 p
(Contract NAS8-21341)
(NASA-CR-102243; D2-139267-1) Avail: CFSTI CSCL 11C

Detailed results are presented on a 10-week fabrication and demonstration of high performance multilayer insulation application to a 45 degree segment mock-up of a 200-inch diameter Torus tank. A mock-up of a 45 degree segment of a 200-inch diameter Torus tank was fabricated of wood and fiber glass. The purge system, constructed of blue nylon for photographic clarity, was fabricated, installed on the mock-up and demonstrated. The insulation system was composed of five blankets of insulation each one-inch thick composed of alternate layers of nylon tulle and aluminized mylar film encapsulated in nylon net. The insulation blanket segments were installed on the mock-up using the designated insulation support systems. Photographs were taken of the mock-up, insulation system fabrication and insulation installation for a sequential record. Author

**N69-37456*#** IIT Research Inst., Chicago, Ill. Technology Center.
**STUDY OF IN SITU DEGRADATION OF THERMAL CONTROL SURFACES Interim Report, 7 Mar. 1967 – 7 Sep. 1968**
G. A. Zerlaut and J. E. Gilligan 7 Mar. 1969 174 p refs
(Contract NAS8-21074; ITTRI Proj. U6061)
(NASA-CR-102239; IITRI-U6061-17) Avail: CFSTI CSCL 11C

The evaluation of the space-environment-induced damage that was sustained by Pegasus 3 spacecraft test coupons and evaluation of the mechanisms of space ultraviolet damage employing gas adsorbate techniques were discussed. Twenty-eight different samples of thermal-control surfaces were irradiated in one or both IRIF-1 and IRIF-2 space-simulation facilities. The in situ behavior of these surfaces were determined and on this basis, gaseous adsorbate tests were planned. These studies have suggested that surface sites may be expeditiously investigated by adsorbate studies. A number of problems inherent in space simulation testing were elucidated and recommendations are advanced on the basis of their interpretation. The role of coating constituents, i.e., curing agents, solvents, and even binders, as contaminants, is discussed. The adsorption of gases and foreign species on the surface of pigments is experimentally evaluated. Author

**N69-37518*#** National Aeronautics and Space Administration, Washington, D.C.
**TEKTITE DISCOVERY**
22 Sep. 1969 5 p
(NASA-News-Release-69-136) Avail: NASA Scientific and Technical Information Division

Research work has produced new evidence to the effect that part of the moon is already on the earth. It was estimated that from 10 to 100 million tons of the moon is here. These lunar showers produced tektites, which is fused glass. The lunar material was sprayed some 700,000 years ago by a large meteorite impact which formed the crater, Tycho. Most of the material appears over Australia, the Philippines, and Southeast Asia. The tektites are analyzed to gain information about the lunar body. E.H.W.

**N69-37581#** Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Service.
**DETERMINATION OF THE MAXIMUM CRACKING VELOCITY OF VARIOUS GLASSES BY THE ULTRASONIC METHOD [BESTIMMUNG DER MAXIMALEN BRUCHGESCHWINDIGKEIT VERSCHIEDENER GLAESER NACH DER ULTRASCHALL-METHODE]**
Frank Kerkhof 1968 16 p refs Transl. into ENGLISH from Glastech. Ber. (Frankfurt am Main), v. 35, no. 6, 1962 p 267–272 *Its* Rel. 727
Avail: CFSTI

The maximum cracking velocity, the elastic data, and the Knoop hardness were re-determined for 18 different glasses from the same batch. The maximum cracking velocity was determined by die ultrasonic method. An investigation was undertaken in particular into the question of whether the values of the maximum cracking velocity were in agreement with the theoretical predictions. Author

N69-37588# Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Service.
**ELECTRIC PROPERTIES OF PYROLUSITE [OB ELEKTRICHESKIKH SVOISTVAKH PIROLIUZITA]**
N. S. Chemeia et al 1969 7 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Ukrania), v. 13, no. 1, 1968 p 67–70 /ts Ref. 748
Avail: CFSTI

The electric properties of manganese dioxide, a compound which is classified as a semiconductor but also possesses certain characteristics of ferroelectrics, were investigated as a function of contact material and method of coating. Two kinds of samples were used: (1) natural pyrolusite from Soviet deposits; and (2) a ceramic sample compressed at a pressure of 6000 kg/cm$^2$. Sample size was 0.2 x 0.6 x 1.2 cm; silver, Aquadag, and indium-gallium contacts were tested. The results obtained differed only slightly in the two specimens, in agreement with earlier tests. These data indicate that the high value of the dielectric constant and the ferroelectric properties of pyrolusite should be regarded as parasitic phenomena in the currently used contacts. A.C.R.

N69-37599# Rubber Research Inst. TNO, Delft (Netherlands).
**STORAGE TESTS IN AIR AT 60 DEG, 100 DEG, AND 120 DEG C WITH TWO HYPALON COMPOUNDS [BEWAARPROEVEN IN LUCHT BIJ 60, 100 EN 120 DEG C, UITGEVOERD MET 2 HYPALONMENGSELS]**
H. Geldof and W. J. v. d. Veen 10 Jan. 1969 7 p In DUTCH (TDCK-52654-3; MAR-6901; Rept-22/69) Avail: CFSTI

Tensile strength and deformation of two different Hypalon plate specimens were determined following the storage tests. A Neoprene specimen and two samples from cable sleeves were subjected to the same tests, and the results were compared with those obtained with the Hypalon specimens. The storage tests were conducted in air as follows: at 120° C for 6 different periods up to 28 days; at 100° C for 4 different periods up to 6 weeks; and at 80° C for 4 different periods up to 6 months. The test results for all materials are shown in tables and briefly discussed. Transl. by K.W.

N69-37619 National Lending Library for Science and Technology, Boston Spa (England).
**DURABLE, COMBINED FLAME-RESISTANT, WATER REPELLENT AND FUNGICIDAL FINISHING OF AIR PERMEABLE CELLULOSIC FABRIC**
L. Krcma 20 Jul. 1969 34 p refs Transl. into ENGLISH from Veda Vyzkum Prumyslu Textil. Prague), no. 9, 1968 p 187–203 (NLL-M-7741-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

The paper is concerned with a permanent, air permeable flame-resistant finish of cellulosic fabrics. The present state of finishes for protective work clothing, chemical constitution of the agents and explanation of the principle of flame propagation and retardation in fabrics, and the effect of cloth permeability on the comfort of labor are reviewed. A new agent is proposed for padding the fabric with a mixture of polyvinyl chloride and chlorinated paraffin in an organic solvent containing finely dispersed antimony trichloride. A thorough study was made of chemical and physical characteristics of the impregnating mixture from the point of view of plastoelastic parameters. The resistance of the mixture against high-energy radiation and weathering was examined by infrared spectroscopy. Test results show that the finish is practically unaffected under testing conditions, so that the finish can be safely applied to cellulosic fabrics. Tests on finished fabrics show that besides permanent flameproof effect, when the application is by the bath method, excellent permeability, slightly improved tenacity, and increased abrasion resistance are produced. Furthermore, on weathering the color of the dying is unchanged. Author

N69-37676# Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Services.
**ELECTRICAL PROPERTIES OF EPOXY RESINS WITH VARYING MOLECULAR WEIGHTS [ELEKTRICHESKIE SVOISTVA EPOKSIDNYKH SMOL RAZLICHNOGO MOLEKULIARNOGO VESA]**
S. N. Antonov et al 1968 8 p refs Transl. into ENGLISH from Plasticheskie Massy (Leningrad), v. 4, 1966 p 38–40 /ts Ref. 702
Avail: CFSTI

The electrical properties of epoxy resins with varying molecular weights obtained by condensation of diphenylol propane and epichlorhydrin are presented. Results show that with increasing molecular weights of uncured epoxy resins their dielectric properties improve and the curves shift in the direction of the higher temperature region. The temprature dependence of dielectric properties characterizes the structure of the cured resin, and the dielectric properties decrease with increasing molecular weight. Author

N69-37688# Central Mechanical Engineering Research Inst., Durgapur (India).
**RESEARCH AND DEVELOPMENT IN ELECTRICAL SHEET STEEL MAKING**
R. A. Padmanabhan Mar. 1969 27 p refs
(MB) Avail: CFSTI

The history of development of magnetic alloys, particularly Fe-Si for use in power transformers is traced. Besides outlining the commercial methods of production of the electrical sheet steels, the physical properties and crystallographic aspects of cold rolled grain oriented silicon steel, particularly directional properties and preferred crystal orientations introduced by the process of cold rolling and annealing are described. The effect of non-metallic impurities in silicon iron and the effect of metallic additions to advantage are also discussed. Author

N69-37789*# Los Alamos Scientific Lab., N. Mex.
**CMF-13 RESEARCH ON CARBON AND GRAPHITE Progress Report, 1 May–31 Jul. 1969**
Morton C. Smith 3 Sep. 1969 38 p refs Sponsored in part by NASA
(Contract W-7405-ENG-36)
(NASA-CR-105896; LA-4337-MS; PR-10; Rept-10) Avail: CFSTI CSCL 11G

Research and development on carbon and graphite were undertaken primarily to increase understanding of their properties and behavior as engineering materials, to improve the raw materials and processes used in their manufacture, and to learn how to produce them with consistent, predictable, useful combinations of properties. The approach taken is microstructural, based on study and characterization of natural, commercial, and experimental carbons and graphites by such techniques as X-ray diffraction, electron and optical microscopy, and porosimetry. Physical and mechanical properties are measured as functions of formulation, treatment, and environmental variables, and correlations are sought among properties and structures. Raw materials and manufacturing techniques are investigated, improved, and varied systematically in an effort to create specific internal structures believed to be responsible for desirable combinations of properties. Author

N69-37833# Boeing Co., Philadelphia, Pa. Vertol Div.
**STATIC AND FATIGUE TEST PROPERTIES FOR WOVEN AND NONWOVEN S-GLASS FIBERS Final Report**
Martin B. Cutler and Robert L. Pinckney Apr. 1969 182 p refs
(Contract DA-44-177-AMC-440(T))
(AD-688871; D8-0826; USAAVLABS-TR-69-9) Avail: CFSTI CSCL 11/6

The static and dynamic properties of alumina-silicate S-glass prepreg materials were investigated. Utilizing a series of process

fabrication parameters, solid laminates, sandwich beams. Tubular specimens were fabricated by fluid pressure (autoclave techniques. The ultimate strengths and fatigue endurance limits of the specimens were determined over an ambient temperature range of minus 65F to 160F. The effects of actual weather, artificial weathering and condensing humidity on structural properties were also determined. A means of reducing room temperature fatigue data on a statistical basis was developed to account for the processing and environmental parameters. Design properties for the materials in helicopter rotor applications are presented in the form of S-N curves. Author (TAB)

**N69-37954#** Central Technical Inst., TNO, Delft (Netherlands).
**PROPERTIES OF PPO IN REGARD TO ITS APPLICATION IN LH TANK INSULATION**
J. A. Knobbout and C. B. Colenbrander May 1969 104 p refs
Avail: CFSTI

A study has been made of the most important properties of polyphenylene oxyde (PPO) and on its possible use for liquid hydrogen tank insulation. Mechanical properties and thermal expansion from 20° to 400°K of PPO sheet and foam were investigated as well as the gas diffusion through PPO foil at room temperature. The bonding strength of adhesive suitable for bonding PPO sheet and PPO foam to itself and aluminium were also investigated. Methodology and results of tests are given. ESRO

**N69-38047#** Naval Research Lab., Washington, D.C.
**GOVERNMENT-INDUSTRY MEETING ON FILTER MEDIA AND MEDIA TESTING**
W. L. Anderson *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf., Dec. 1968 p 79-85 (See N69-38042 22-22)
Avail: CFSTI

Results of a meeting of a working group in high efficiency filters are briefly reviewed. Four topics were discussed at the meeting: (1) a survey to determine the status of compliance with specifications for filter materials, (2) a moisture resistance test program, (3) the availability of a glass fiber reported to have good acid and chemical resistivity for filter materials, and (4) the lowering of shipping rates for HEPA filter units. E.C.

**N69-38061#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
**CHARCOAL POST TREATMENT. HEAT DEGRADATION AND SERVICE LIFE**
R. C. Milham *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf., Dec. 1968 p 167-189 refs (See N69-38042 22-22)
Avail: CFSTI

Efforts to extend the service life of activated carbon in a reactor confinement system are reviewed. Work in progress includes investigations of the variables that affect the desorption of iodine from activated carbon, and the effects of service, temperature, face velocity, iodine loading, impregnation, and partial regeneration. E.C.

**N69-38052#** Oak Ridge National Lab., Tenn. Reactor Chemistry Div.
**AGING AND WEATHERING OF IMPREGNATED CHARCOALS USED FOR TRAPPING RADIOIODINE Interim Report**
R. D. Ackley and R. E. Adams *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf., Dec. 1968 p 170-184 refs (See N69-38042 22-22)
Avail: CFSTI

Aging, weathering, and poisoning are processes which might adversely affect charcoal performance, especially with regard to trapping radioiodine in the form of methyl iodide ($CH_3I$). Effort has been applied toward investigating the effects of the above processes. The bulk of the data thus far obtained correspond to three different types of charcoal. Two types are iodized, to provide isotopic exchange capability, and the other is triethylenediamine-impregnated. The influences of the processes were examined by observing the variation of $^{131}I$ of $CH_3{}^{131}I$ removal capability for the iodized charcoals or in $CH_3I$ removal capability for the amine-impregnated charcoal. The results indicate the following: (1) aging has little or no effect on impregnated charcoal performance; (2) weathering with air at around 50% relative humidity has an appreciable effect; and (3) poisoning of iodized charcoal can have a large effect. Author

**N69-38067#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
**CONTRIBUTION TO THE STUDY OF INTERNAL FRICTION IN GRAPHITES [CONTRIBUTION A L'ETUDE DU FROTTEMENT INTERIEUR DES GRAPHITES]**
Jacques Merlin (Ph.D. Thesis Lyon Univ.) Jun. 1969 241 p refs In FRENCH; ENGLISH summary
(CEA-R-3820) Avail: CFSTI

A study has been made of the internal friction in different graphites between −180°C and +500°C using a torsion pendulum. The graphites had previously been treated thermo-mechanically, by neutron irradiation and subjected to partial annealings. It has been shown that there occurs: (a) a hysteretic-type dissipation of energy, connected with interactions between the dislocations and other defects in the matrix; (b) a dissipation having a partially hysteretic character which can be interpreted by a Granato-Lücke type formalism and is connected with the presence of an 'ultra-microporosity; (c) a dissipation by a relaxation mechanism after a small dose of irradiation; this is attributed to the reorientation of bi-interstitials; (d) a dissipation having the characteristics of a solid-state transformation, this during annealing after irradiation. It is attributed to the reorganization of interstitial defects. Some information has thus been obtained concerning graphites, particularly their behavior at low mechanical stresses, the nature of irradiation defects and their behavior during annealing, the structural changes occurring during graphitization and the relationship between internal friction and microscopic mechanical properties. Author (ESRO)

**N69-38186#** Owens-Corning Fiberglass Corp., Granville, Ohio. Technical Center.
**GLASS FIBER REINFORCED PLASTIC TIRES FOR THE MARGINAL TERRAIN VEHICLE Final Report**
James C. Hood Apr. 1968 29 p refs
(Contract DAAE07-67-C-3853)
(AD-689503; ATACOM-TR-10528) Avail: CFSTI CSCL 13/6

The report discusses a program to develop and fabricate glass fiber reinforced plastic tires for use on the Marginal Terrain Vehicle. These tires were to have been non-pneumatic, hence were to have provided a tire having post-damage "get home" capabilities and several configurations of tires were fabricated for test. Author (TAB)

**N69-38487#** Los Alamos Scientific Lab., N.Mex.
**CMF-13 RESEARCH ON CARBON AND GRAPHITE Progress Report, 1 Nov. 1968 - 31 Jan. 1969**
Morton C. Smith 21 Mar. 1969 31 p refs
(Contract W-7405-ENG-36)
(LA-4128) Avail: CFSTI

Mix formulations, molding conditions, and properties of hot-molded anisotropic graphites are tabulated. Filler-particle characteristics on the properties of a graphite made from that filler are predictable. Experiments were performed on binary filler materials. A systematic comparison was made of the properties of the extruded graphites made from the fillers. NSA

**N69-38483#** Army Foreign Science and Technology Center, Washington, D.C.
**SILICATE-ZINC ANTIFOULING PAINTS. STUDIES ON**

**ANTIFOULING PROPERTIES**
Zbigniew Jedlinski 5 May 1969 14 p refs Transl. into ENGLISH from Przemysl Chem. (Warsaw), no. 11, 1968 p 687–689
(AD-688536; FSTC-HT-23-141-69) Avail: CFSTI CSCL 11/3

Accelerated and land tests proved that the action of preservative coatings consisting of silicate paints depends on the content of oxides of copper in the paint making up the external layer of the coating. The content of CU20 is increased, the anticorrosion properties decrease and antifouling properties become better. Coatings with 21.18 CU20 have good anticorrosion properties but insufficient antifouling properties, primarily as concerns barnacles. The addition of zinc oxide (21% CU20 and 33.5% ZN at the optimum) improves antifouling without harming anticorrosion properties. Author (TAB)

N69-38597# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**DEPENDENCE OF THE MAGNITUDE OF ADHESIVE STRENGTH ON LOADING CONDITIONS**
Yu. A. Gorbatkina 10 Mar. 1969 10 p refs Transl. into ENGLISH from Russian Conf. Paper Presented at the Conf. on Physiochem. Mech. of Porous and Fibrous Dispensed Struct. and Mater., Riga, 1967
(AD-689715; FTD-HT-23-1177-68) Avail: CFSTI CSCL 11/4

The magnitude of the adhesive bond strength formed between alkali-free glass fibers and phenolic resins and was determined as a function of applied shear load. A detailed description of the preparation of the experimental specimens is given. The polymerization was carried out by initial slow heating for two hours from room temperature to 80°C; heating at 80° for two hours; heating to 130°C over a period of two hours; annealing at 130°C two hours, heating at 180°C for 1 hour, and finally by cooling to room temperature over a period of 6-7 hours. The bond area was 0.35—0.45mm (superscript 2) for BF-4 resin, and .75—.85mm (superscript 2) for BF-6 resin. The strength of adhesion was determined on a Shopper type testing machine. It was found that for both adhesives the shear strength of the specimens was a linear function of the logarithm of the applied shear load rate. Author (TAB)

# 19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-37209# Wisconsin Univ., Madison. Mathematics Research Center.
**SCHAUDER DIMENSION IN BANACH SPACES**
Richard Tapia and John Evans Nov. 1968 10 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-689418; MRC-TSR-883) Avail: CFSTI CSCL 12/1

A relationship between Hamel and Schauder dimension in Banach spaces is established. Author (TAB)

N69-37212# Wisconsin Univ., Madison. Mathematics Research Center.
**A SECOND LOOK AT APPROXIMATE QUADRATURE FORMULAE AND SPLINE INTERPOLATION**
I.J. Schoenberg Feb. 1969 35 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-689414; MRC-TSR-966) Avail: CFSTI CSCL 12/1

The construction of best quadrature formulae is generalized in two ways. Firstly, integrals are discussed having an arbitrary preassigned weight function. Secondly, the most general boundary conditions are determined. Author (TAB)

N69-37214# Illinois Univ., Urbana. Coordinated Science Lab.
**A CHARACTERIZATION OF BIPLANAR GRAPHS**
Shunichi Toida May 1969 45 p refs
(Contract DAAB07-67-C-0199)
(AD-688833; R-415) Avail: CFSTI CSCL 12/1

A graph is called biplanar if it can be permitted into two planar graphs. For example planar graphs are biplanar. Relations between biplanar graphs and degree of their vertices are sought. The following are main results: If every vertex in a graph has degree less than 5, then the graph is biplanar. If every vertex in a graph has degree greater than 11 then the graph is not biplanar. There is a graph regular of degree 7 which is not biplanar, but we do not know whether graphs regular of degree 5 or 6 are biplanar or not. There is no known method of constructing non-biplanar graphs. One way of doing that from a given nonbiplanar graph is presented. Author (TAB)

N69-37246# California Univ., Berkeley. Operations Research Center.
**INFINITESIMAL LOOK-AHEAD STOPPING RULES**
Sheldon M. Ross Apr. 1969 20 p refs
(Contracts Nonr-222(83); DA-31-124-ARO(D)-331; Grant NSF GP-8895)
(AD-688150; ORC-69-7) Avail: CFSTI CSCL 12/2

The continuous time optimal stopping problem is considered and an infinitesimal look ahead procedure is defined. Sufficient conditions are then given which ensure that this procedure, which is the continuous time analogue of the one stage look ahead rule in the discrete time problem, is optimal. These results are then applied to a class of continuous time Markov decision processes. Author (TAB)

N69-37253# Catholic Univ. of America, Washington, D.C.
**A GENERAL NONLINEAR RELAXATION ITERATION TECHNIQUE FOR SOLVING NONLINEAR PROBLEMS IN MECHANICS**
Nicholas Perrone and Robert Kao Aug. 1969 21 p refs
(Grant NSF GK-2802)
(Rept-14) Avail: CFSTI

The nonlinear relaxation method, an iterative approach used in conjunction with finite difference approximations, is illustrated via the solution to a very simple problem. Subsequently, the method is used to solve three geometrically nonlinear problems in mechanics: finite bending of a circular thin walled tube, the large deflection membrane response of a spherical cap, and finite deformations of a uniformly loaded circular membrane. Formulations for the three problems are quite different but this difference does not inhibit the use of the nonlinear relaxation technique. Solutions were obtained in approximately one man day per problem including the total time devoted to examining, planning, programming, debugging, etc. Solutions compare very favorably with results found elsewhere in the literature. The essential and important advantages of the nonlinear relaxation technique are: (1) versatility and ease of application, (2) efficiency with respect to people and computer time utilized, (3) insensitivity to starting values as far as convergence is concerned, and (4) simplicity of logic that makes it a trivial task to learn how to employ it. Author

N69-37278# Kentucky Univ., Lexington. Dept. of Mathematics.
**FORMATIONS OF FINITE PI-CLOSED GROUPS II**
James C. Beidleman and Ben Brewster [1969] 9 p refs
Submitted for publication
(Grant NSF GP-8627)
Avail: Issuing Activity

In the present paper we continue our study of formations of finite $\pi$-closed groups, $\pi$ a set of prime numbers. Let $P_\pi$ denote the complement of $\pi$ in the set of all prime numbers and let $\mathfrak{F}$ be a formation (see [6, 7, 9]). Let $\mathfrak{F}(\pi,h)$ denote the class of extensions of a $\pi$-group by a group from $\mathfrak{F}$ of relatively prime

order. Then $F(\pi,\theta)$ is a formation; moreover if $\theta$ is saturated, then $F(\pi,\theta)$ is also saturated. The main purpose of the present paper is to prove the following theorem: Let $\theta$ be a saturated formation. Every finite $P_\pi$-solvable group possesses an $F(\pi,\theta)$-covering subgroup, and all such subgroups are conjugate. Author

**N69-37288#** Weapons Research Establishment, Adelaide (Australia).
**ERROR ESTIMATES IN THE FINITE DIFFERENCE SOLUTION OF ELECTROMAGNETIC PROBLEMS**
D. H. Sinnott Jul. 1969 57 p refs
(WRE-TN-ED-171) Avail: CFSTI

The sources of errors in finite difference solutions to Laplace's equation and the Laplacian eigenproblem are considered. Asymptotic error estimates are derived which indicate the rate of convergence of the approximate solution to the exact solution as the discretization interval tends to zero. It is shown how a knowledge of asymptotic error estimates permits estimates of the discretization necessary for a prescribed accuracy of solution and how extrapolation from several results may improve the order of accuracy. The effect of field singularities is carefully investigated. Both pointwise errors, and errors in the quadratic functional are included in the treatment. Author

**N69-37323#** Kentucky Univ., Lexington.
**THE NORMAL INDEX OF MAXIMAL SUBGROUPS IN FINITE GROUPS**
J. C. Beidleman and A. E. Spencer [1969] 14 p refs Submitted for publication
(Grant NSF GP-8672)
Avail: Issuing Activity

The normal index of a maximal subgroup M in a finite group G is defined as the order of a chief factor H/K of G where H is minimal in the set of normal supplements to M in G. $\eta(G:M)$ denotes this number. The finite group G is obtained as a corollary to a theorem on p-solvability. It is shown that if G has at least one solvable maximal subgroup M such that $\eta(G:M) = |G:M|$, then G is solvable. All groups are assumed to be finite. G.G.

**N69-37324#** Kentucky Univ., Lexington.
**FORMATIONS OF PI-CLOSED FINITE GROUPS I**
J. Beidleman and B. Brewster [1969] 19 p refs Submitted for publication
(Grant NSF GP-8627)
Avail: Issuing Activity

Let $\Theta$ denote a homomorph of finite groups and let $\pi$ be a set of prime numbers. Let $F(\pi,\Theta)$ denote the class of extensions of a $\pi$-group from $\Theta$ by a group of relatively prime order. If $\Theta$ is a homomorph, then $F(\pi,\Theta)$ is a homomorph. The homomorph $\Theta$ is termed strictly saturated if $H/O(G) \in \Theta$, H a normal subgroup of the group G, implies $H \in \Theta$. The main purpose of the present paper is to prove the theorem: Let $\Theta$ be a homomorph and let $F(\pi,\Theta)$ be a saturated formation. If G is $\pi$-solvable, then G possesses an $F(\pi,\Theta)$-covering subgroup and all such subgroups are conjugate. If $\pi$ denotes the set of all prime numbers and $\Theta$ is a saturated formation, then G possesses a $\Theta$-covering subgroup and all such subgroups are conjugate. Author

**N69-37348*#** Tulane Univ., New Orleans, La.
**SOLUTION OF SYSTEMS OF NONLINEAR EQUATIONS Final Report**
Victor J. Law [1969] 70 p
(Contract NAS8-21484)
(NASA-CR-102245) Avail: CFSTI CSCL 12A

A generalized method called diagonal discrimination for nonlinear algebraic and transcendental equations is described. A computer program which implements this technique has been written in FORTRAN 4 for the Univac 1108 computer. A user's manual is included which gives detailed instructions of how to implement the computer program. Author

**N69-37406#** Helsinki Univ. (Finland). Radio Lab.
**A COLLECTION OF DYADIC IDENTITIES IN THREE DIMENSIONAL VECTOR CALCULUS**
Ismo V. Lindell 1968 21 p refs
(Rept-S-24-1968) Avail: CFSTI

In this report different products between dyadics in vector calculus are defined and a collection of algebraic identities using these products is presented. Author (ESRO)

**N69-37438#** Royal Inst. of Tech., Stockholm (Sweden). Div. of Aeronautics.
**DISCRETE CONTROL WITH POISSON DISTRIBUTED CONTROL ACTIONS**
Fritz Hjelte May 1969 106 p refs
(KTH-AERO-TN-56) Avail: CFSTI

This technical note presents an analysis of a certain type of discrete control. The control signals are arbitrary functions of time and occur as random events with a Poisson distribution. Their magnitude depends linearly on the control error. The controller acts on a plant with a linear but otherwise arbitrary transfer function. It is shown that the ensemble mean values of the control system signals can be obtained from an equivalent continuous control system that can be treated with conventional transfer function methods. The difference between the discrete control system and its continuous equivalent can be quantitatively evaluated by means of the ensemble dispersion. Analytical expressions for the dispersion functions are given. This type of control may occur in situations where control precision is of minor importance and the controller's attention is interrupted by more vital tasks. Such a controller can be either a time shared information processing device or a distracted human controller in manual control. Author

**N69-37479#** Michigan Univ., Ann Arbor. Computer Information and Control Engineering.
**COMPUTATION OF OPTIMAL CONTROLS Final Scientific Report**
Elmer G. Gilbert May 1969 11 p refs
(Grant AF-AFOSR-814-66)
(AD-689466; AFOSR-69-1607TR) Avail: CFSTI CSCL 12/1

The research was in the general areas of system theory and control theory with a fairly strong emphasis on computational algorithms for optimal control problems. Research reports and publications are listed. A brief review of the research efforts is given. TAB

**N69-37486#** Kentucky Univ., Lexington. Dept. of Mathematics.
**THETA-FRATTINI SUBGROUPS OF FINITE GROUPS**
James C. Beidleman and Don Dykes (Kent State Univ.) [1969] 27 p refs Submitted for publication Sponsored in part by Kent State Univ. Prepared jointly by Ky. Univ. and Kent State Univ.
(Grant NSF GP-8672)
Avail: Issuing Activity

Let $\theta$ be a class of finite groups which is subgroup-inherited and homomorphism-invariant. A normal subgroup H of the finite group G is termed a $\theta$-Frattini subgroup of G provided that if K is a normal subgroup of G such that $K/H \in \theta$, then $K \in \theta$. In developing the theory of $\theta$-Frattini subgroups, it is usually assumed that the product of normal $\theta$-subgroups, denoted $P_\theta(G)$, is a $\theta$-subgroup of G. It is proven that a normal subgroup H of G is a $\theta$-Frattini subgroup of G if and only if $P_\theta(G/H) = P_\theta(G)/H$. If $\theta$ is the class of finite nilpotent groups, then a normal subgroup H of G is a $\theta$-Frattini subgroup of G if and only if H is a generalized Frattini subgroup of G. In general the product of $\theta$-Frattini subgroups of G need not be a $\theta$-Frattini subgroup. Author

N69-37523# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
**THE GREEDY ALGORITHM FOR FINITARY AND COFINITARY MATROIDS**
Victor Klee (Washington Univ., Seattle) May 1969 33 p refs
(Contract N00014-67-A-0103)
(AD-689101; D1-82-0851) Avail: CFSTI CSCL 12/1

The notion of a matroid was introduced by H. Whitney in 1932, in order to provide a unified treatment of the dependence structures of graph theory and linear algebra. In more recent years, the same notion has served to unify other areas of combinatorial mathematics. For example, the so-called greedy algorithm for finite matroids contains, as special cases, an algorithm for finding optimal assignments (of people to jobs, for example) and an algorithm for finding the shortest spanning tree of a graph (useful in the design of communication or transportation networks for certain purposes). The present report is concerned primarily with the extension of matroid theory so as to apply to infinite as well as finite systems. It contributes to matroid axiomatics and shows that the greedy algorithm applies to two important classes of infinite matroids. Author (TAB)

N69-37686# Sheffield Univ. (England). Dept. of Probability and Statistics.
**MIXTURE DESIGNS FOR A MODEL LINEAR IN THE PROPORTIONS**
N. G. Becker Mar. 1969 22 p refs
(RR-57/N6B-3) Avail: CFSTI

When the predictor variables of a regression model are the n proportions of a mixture, the experimental region is contained in a (n-1)-dimensional regular simplex. A model linear in proportions is considered to be fitted to observed responses. Designs are treated which minimize the mean-squared deviation averaged over the simplex, when the true model is taken to be a quadratic in the proportions. Author

N69-37689# Sheffield Univ. (England). Dept. of Probability and Statistics.
**STANDARD GROUPS WITH A QUASI-INVARIANT MEASURE**
G. L. Burrell Jan. 1969 17 p refs
(RR-55/GLB-1) Avail: CFSTI

Further analysis is presented of a theorem in which a standard group, X, has a non-trivial $\sigma$-finite left invariant measure. There is then a topology on X whose open sets generate the same $\sigma$-field as B; so that with this topology X becomes a locally compact topological group. In addition, it is known that, given a locally compact topological group, there exists a unique translation invariant measure on the group. The purpose of the analysis is to prove that when a quasi-invariant measure on a standard group is given, a topology can be defined on the group which generates the same $\sigma$-field as the original one and under which it becomes a locally compact topological group. The approach used for the proof differs somewhat from the original theorem, avoiding an assertion regarding X that may possibly not be valid, and thus offers some independent interest. A.C.R.

N69-37614*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SOME GENERALIZED POWER SERIES INVERSIONS**
R. H. Estes and E. R. Lancaster Sep. 1969 17 p refs Submitted for publication
(NASA-TM-X-63676; X-643-69-400) Avail: CFSTI CSCL 12A

A function $G(\xi, \eta, \tau) = 0$ is expanded as a tri-variate power series and a general inversion algorithm derived. Various important special cases are examined, including a two dimensional generalization of the Schlomilch – Cesaro recursion formula for the high order derivatives of a function of a function. Author

N69-37628# RAND Corp., Santa Monica, Calif.
**INFINITELY DIVISIBLE DISTRIBUTIONS, CONDITIONS FOR INDEPENDENCE, AND CENTRAL LIMIT THEOREMS**
Percy A. Pierre May 1969 29 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-689158; RM-6042-PR) Avail: CFSTI CSCL 12/1

A discussion is given of some general results for a class of random vectors that often arise in the modeling of radar clutter interference. If a random variable is the sum of a large number of small, statistically independent components, it can under certain conditions be approximated by the normal distribution. When these conditions cannot be obtained, the random variable can be approximated by a member of a broader class of infinitely divisible (I.D.) random variables. Conditions for independence are developed and a new parameter defines dependence between non-normal components of two I.D. random variables. Central limit theorems for sequences of I.D. variables and sequences of sums of small independent random variables employ characterizations of normal and Poisson distributions. Author (TAB)

N69-37633# Louisiana State Univ., Baton Rouge. Dept. of Chemical Engineering.
**USE OF SEARCH TECHNIQUES TO DETERMINE OPTIMAL SWITCHING TIMES**
John A. Miller, Cecil L. Smith, and Paul W. Murrill New York Am. Inst. of Chem. Engr. Mar. 1969 14 p refs Presented at 64th Natl. Am. Inst. of Chem. Engr. Meeting, Symp. on Optimization Appl., New Orleans, 16 – 20 Mar. 1969 Submitted for publication
*Its* Preprint 22-C
(Contract F44620-68-C-0021)
(AD-689131; AFOSR-69-1408TR) Avail: CFSTI CSCL 12/1

An important part of most modern digital control systems is the supervisory or steady-state optimization programe. The purpose of these second level programe is to determine optimum values for the set-points of the first level control loops. Today most first level control loops are adjusted for a compromise between good set-point responses and good load responses. This paper will present a practical technique for obtaining good set-point responses, while allowing the first level controllers to be tuned for good regulator action so that load disturbances will be well-compensated. Author (TAB)

N69-37687# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Systems Research Section.
**SIMULATION OF A RANDOM INVENTORY PROCESS WITH AN ADAPTIVE, FEEDBACK CONTROL**
J. Abbate Sep. 1969 30 p refs
(RM-456) Avail: CFSTI

The use of a computer program, written in GPSS/360 language, which simulates a random inventory process in order to determine the effectiveness of a proposed adaptive inventory policy is described. The standard solution to the inventory problem presented in most of the current literature is concerned with the minimization of total inventory costs when inventory holding costs and procurement costs are considered, and is based on a gross approximation to the inventory process. Direct application of this solution to an actual inventory process could result in severe shortages or excesses. Consequently, several modifications to the standard solution are proposed, and the result is shown to be a near-optimal, adaptive, feedback control policy. This control policy is applied in the inventory simulation, and the wide variety of output statistics available from the program can be used to determine system sensitivity to control policy changes and parameter variations. Author

N69-37713# Stanford Univ., Calif. Dept. of Statistics.
**FORMAL BAYES ESTIMATION WITH APPLICATION TO A RANDOM EFFECTS ANALYSIS OF VARIANCE MODEL**
Stephen Lane Portnoy Feb. 1969 64 p refs Revised

(Contract Nonr-225(52))
(AD-689226; TR-142A-Rev) Avail: CFSTI CSCL 12/1

Techniques of formal Bayes estimation are discussed and applied to the estimation of the components of variance in the one way layout random effects ANOVA model. Invariant formal Bayes estimators are presented and proved to be admissible in certain classes of invariant rules and also minimax. To do this a general sufficient condition for admissible in certain multiparameter problems is given and applied to the ANOVA problem. Numerical calculations of mean squared errors of various estimators are also presented, and these results help justify the recommendation of the formal Bayes estimators. Author (TAB)

**N69-37713#** Stanford Univ., Calif. Dept. of Statistics.
**SEQUENTIAL ESTIMATION IN THE UNIFORM DENSITY**
Peter J. Cooke 21 Apr. 1969 19 p refs
(Contract Nonr-225(52))
(AD-689229; TR-144) Avail: CFSTI CSCL 12/1

A solution is given to the problem of sequentially estimating (to within d > 0 units of the true value) the parameter theta of a uniform distribution on (0, theta). The solution is optimal in the sense that the expected number of observations is minimized. It is also minimax in that the maximum possible number of observations is minimized. Some tables are appended. Author (TAB)

**N69-37724#** Syracuse Univ., N.Y.
**CONSERVED QUANTITIES IN GRAVITATIONAL RADIATION THEORY**
Edward Nathan Glass (Ph.D. Thesis) Aug. 1969 117 p refs
Sponsored by NSF
Avail: Issuing Activity

The N – P constants, which lead to selection rules for gravitational transitions, and their associated symmetries are investigated and earlier theories extended. Of the infinite set of flat space N – P constants, only the first members are preserved as constants in curved space. The invariant transformations which they generate were found to be incoming multipole waves with support restricted to future null infinity. The nonexistence of higher order constants is discussed, and the invariant transformations they would generate are examined. Higher multipole wave perturbations were obtained from the infinitesimal form of the field equations by a self-consistent field calculation. The fact that the gravitational constants are obtained from the shear of the outgoing null geodesics suggests a close connection between the constants and physical sources, since part of the shear arises from the multipole structure of sources. No additional understanding of the selection rules imposed by the constants on radiative processes was gained; this topic along with studies of the effect of space – time boundary conditions requires further analysis for deeper insight into the N – P constants. A.C.R.

**N69-37748#** Wisconsin Univ., Madison. Mathematics Research Center.
**ON THE APPROXIMATE SOLUTION OF ONE-PHASE FREE BOUNDARY PROBLEMS IN TWO DIMENSIONS Technical Summary Report**
C. W. Cryer Aug. 1968 92 p refs
(Contracts DA-31-124-ARO(D)-462; N00014-67-A-0126-0004)
(AD-689430; MRC-TSR-894) Avail: CFSTI CSCL 12/1

An algorithm for solving one-phase free boundary problems in two dimensions using finite differences is described. The algorithm is used to compute approximate solutions to four problems. Author (TAB)

**N69-37749#** Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
**THE PREDICTION OF OPERATIONAL SUCCESS, SEPTEMBER 1966 – DECEMBER 1967**
Joseph W. Duroux 16 Jun. 1969 41 p refs
(Contract F04701-68-C-0200)
(AD-689748; TR-0200(4306-01)-3; SAMSO-TR-69-185) Avail: CFSTI CSCL 14/4

A general procedure for obtaining a direct estimate of confidence in the success of a process is developed. The measure of confidence is an expected value of reliability based on a Bayesian a posteriori distribution. A flexible model of the a priori distribution permits the combination of a priori estimates with the results of either attribute (success or failure, or variate (measurement) testing. A self-contained applications section summarizes the methods of computation. Author (TAB)

**N69-37748#** Princeton Univ., N.J. Dept. of Electrical Engineering.
**FIXED ERROR, PIECEWISE-LINEAR UNIFORM APPROXIMATION OF FUNCTIONS**
Theodosios Pavlidis May 1969 17 p refs
(Contract DAHCO4-69-0035)
(AD-688521; TR-28; AROD-8244.2-A) Avail: CFSTI CSCL 12/1

A method is described which allows one to determine segments of an interval where a given function can be approximated by a line with maximum absolute error less than a prespecified quantity delta. If the function to be approximated is convex or concave, then the proposed procedure gives the minimum number of segments. For other functions it gives results which are closer to the minimum than the estimates based on the remainder formula. The method is very easy to implement on a computer. Author (TAB)

**N69-37765#** Louisiana State Univ., Baton Rouge. Dept. of Mathematics.
**SELECTED PROBLEMS IN APPROXIMATION THEORY Final Scientific Report, 1 Oct. 1966 – 31 Oct. 1968**
Pasquale Porcelli May 1969 9 p refs
(Grant AF-AFOSR-1214-67)
(AD-689428; AFOSR-69-1596TR) Avail: CFSTI CSCL 12/1

Three projects were completed during the first of this two year research effort: (1) Results concerned with an Abelian and symmetric subring on a Hilbert space such that the commutant of the subring has a cyclic vector, (2) work involving applications of the above results to the study of representations of locally compact groups, (3) editing of the Proceedings of the International Symposium on C* algebras and their application to physics. During the second year of this period several papers were written. Results were obtained concerning maximal ideals of the group algebra of a locally compact Abelian group. The results enabled the use of techniques of spectral synthesis to study the ideal structure in the group algebra. Various other results of Banach and Hilbert space theory were obtained during this period. Author (TAB)

**N69-37779#** Brown Univ., Providence, R.I. Div. of Applied Mathematics.
**ON IGNORING THE SINGULARITY IN NUMERICAL QUADRATURE**
R. K. Miller [1969] 20 p refs
(Grants NGL-40-002-015; AF-AFOSR-67-0693A)
(NASA-CR-105894) Avail: CFSTI CSCL 12A

Ignoring the singularity in numerical quadratures was investigated with compound quadrature rules approximating the monotone. Interpolatory type quadratures were also examined. Theorems on error bounds and convergence rates were established. J.A.M.

**N69-37791#** Sheffield Univ. (England). Dept. of Probability and Statistics.
**SIMULTANEOUS QUANTAL AND QUANTITATIVE RESPONSES**
J. B. Gamer Nov. 1968 16 p refs

(RR-51/JBG-3) Avail: CFSTI

A significance test from the Neyman–Pearson viewpoint for simultaneous quantal and quantitative responses is reviewed. It is shown that this type of problem is simplified by using the Bayesian viewpoint. Tests of the null hypothesis are established both by means of Bayes factors and by means of conventional Bayesian methods. One-sided Bayes factors are constructed to aid comparison, not as an argument for the use of such one-sided factors. Application of this approach is demonstrated by means of three examples. K.W.

**N69-37798#** Navy Postgraduate School, Monterey, Calif.
**ON PRIMAL INTEGER PROGRAMMING METHODS**
Howard Thomas Schottle (M.S. Thesis) Dec. 1968 44 p refs
(AD-689730) Avail: CFSTI CSCL 12/2

Advances in the field of integer programming have recently been made by Young and Glover, who have developed primal all integer integer programming alorithms. It is the purpose of this paper to gain computational experience and suggest techniques to improve the efficiency of the algorithm. A first phase procedure is developed to obtain an initial feasible integer solution. Author (TAB)

**N69-37817#** Wisconsin Univ., Madison. Mathematics Research Center.
**THE WEAK NEWTON METHOD AND BOUNDARY VALUE PROBLEMS**
Richard A. Tapia Oct. 1968 26 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-689413; MRC-TSR-949) Avail: CFSTI CSCL 12/1

A Newton-like method called the weak Newton method is described. This procedure coincides with the standard Newton-Kantorovich method whenever the latter is well-defined. The weak Newton method is applied to a large class of two point boundary value problems including the Euler-Lagrange equation for simple variational problems. The Newton-Kantorovich method is not well-defined for this class of problems. Numerical solutions to three well-known variational problems which were obtained using this procedure are included. Author (TAB)

**N69-37821#** Illinois Univ., Urbana. Coordinated Science Lab.
**SOME RESULTS IN THE THEORY OF ARITHMETIC CODES**
R. T. Chien, S. J. Hong, and F. P. Preparata May 1969 31 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-1690)
(AD-688935; R-417) Avail: CFSTI CSCL 9/4

The paper presents a simple number-theoretic investigation of the structure of binary arithmetic AN codes. The range (0, B-1) of represented integers is related to the code length n through ((2 to the nth power)-1 = AB). The analysis is based on the partition of the integers 1 = or < N = or < B-1 into orbits, which are analogous to cosets of the multiplicative subgroup of the powers of 2 modulo B. It is shown how the code minimum weight is related to the members of the orbit. The properties of sets of prime powers are used in developing a simple search strategy for codes. An important consequence of the presented analysis is the construction of codes of moderate distance and high rate, thereby filling the spectrum between the two known extremes of the single-error correcting Brown codes and of the maximum-sequence-like codes of Barrows and Mandelbaum. A list of codes of length = or < 36 is finally presented. TAB

**N69-37828#** Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
**A NOTE ON COMPLEX RECURSIVE CHARACTERISTIC FUNCTIONS Interim Scientific Report**
E. M. Mc Creight May 1969 9 p refs
(Contract F44620-67-C-0058)
(AD-688841; AFOSR-69-1472TR) Avail: CFSTI CSCL 12/1

There are 0-1 valued functions c(x) such that any program with index i computing c(x) takes a large number of steps except at log of i to the base 2 values of x. Author (TAB)

**N69-37826#** Michigan Univ., Ann Arbor. Logic of Computers Group.
**ADAPTIVE PLAN OPTIMAL FOR PAYOFF-ONLY ENVIRONMENTS**
John H. Holland May 1969 9 p refs
(Contracts DA-31-124-ARO(D)-483; N00014-67-A-0181; Grant NIH GM-12236-03)
(AD-688839; TR-08226-10-T) Avail: CFSTI CSCL 9/2

The paper characterizes a class of adaptive algorithms, the reproductive plans, which produce optimal performance in conditions where the information fed back to the algorithm consists only of a payoff at each instant of time. The payoff function, can by any bounded (non-linear) function of the algorithms output space. The reproductive plans have the advantage that they achieve a global optimum (over the whole time course) via a local step-by-step optimization of well-defined quantities. The theorem guaranteeing optimal performance is a modification of the Kuhn-Tucker fixed point theorem closely related to Gale's work in mathematical economics. Author (TAB)

**N69-37828#** Sheffield Univ. (England). Dept. of Probability and Statistics.
**A BAYESIAN TEST FOR EQUALITY OF MEDIANS**
J. B. Garner Apr. 1969 9 p refs
(RR-59/JBG-6) Avail: CFSTI

Let a sample be drawn from each of two continuous distributions, and the two samples be jointly ordered. The present note finds the Bayes factor for the null hypothesis that the two populations have the same median based on contingency methods. Although there is a well-known frequentist test for this circumstance the proof requires the assumption of equality of the two populations under the null hypothesis. The present test requires no such assumption and is particularly useful where this assumption clearly fails. Author

**N69-37829#** Sheffield Univ. (England). Dept. of Probability and Statistics.
**INFORMATION CONTENT OF INTERMITTENT REALIZATIONS FROM FINITE MARKOV CHAINS**
I. V. Basawa Mar. 1969 21 p refs
(RR-58/IVB-2) Avail: CFSTI

The properties of two special types of intermittent realizations and the corresponding estimation procedures are studied. It is noted that it is sometimes possible to increase the efficiency of the estimate by deliberately resorting to sampling intermittent observations rather than taking successive observations. Also if the original chain is periodic, the large sample properties of maximum likelihood estimates based on the conventional sample of successive observations no longer hold true. This difficulty can be overcome by using a suitably chosen intermittent sample. The approach of resolving the properties of sequences drawn from a continuous time, finite state Markov chain was used to derive the corresponding properties of Bernoulli sequences. Author

**N69-37838#** Directorate of Tactical Analysis, 7th Air Force, San Francisco, Calif.
**SOME REMARKS ON CIRCULAR PROBABLE ERROR AND OTHER STATISTICS OF TWO-DIMENSIONAL DISTRIBUTIONS**
James F. Gallagher Jun. 1969 12 p refs
(AD-689780) Avail: CFSTI CSCL 12/1

A definition is given of Circular Probable Error (CEP) as used in papers produced by the US Seventh Air Force Operations

Research Division. Other statistical parameters used in publications of that office are also discussed, as well as orientations used in analyses of navigational and weapon-delivery errors. A graphical method is presented for transforming from Standard Deviations on two orthogonal axes to CEP. Author (TAB)

**N69-37836#** California Univ., La Jolla, Calif. Dept. of Mathematics.
**RESEARCH IN COMPLEX ANALYSIS Final Report, 16 Sep. 1965 – 15 Sep. 1968**
Helmut Rohrl Jan. 1969 6 p refs
(Grant AF-AFOSR-920-65)
(AD-688243; AFOSR-69-1282TR) Avail: CFSTI CSCL 12/1

The principle topics investigated include the Cauchy-Weil representation for sections in coherent analytic sheaves, boundary value problems and the Poincare-Lefschetz mapping, the notion of quadratic forms, equalities and inequalities, the foundation of category theory, a categorical setting for determinants and traces, welding Riemann surfaces and transmission problems with shifts, singular integral equations with shifts, the discrete Wiener-Hopf equation, traces for modules with applications to algebras and quasi-separable algebras. Author (TAB)

**N69-37838#** Sheffield Univ. (England). Dept. of Probability and Statistics.
**ESTIMATION OF AN UNKNOWN PARAMETER IN AN ABSORBING MARKOV CHAIN VIA THE QUASI-STATIONARY DISTRIBUTION**
J. Matthews Nov. 1968 28 p refs
(RR-52/JM-1) Avail: CFSTI

Realizations of a given length of an absorbing Markov chain are studied on conditions that no absorption is taking place. It is shown that as the length of the realization is increased, the case in effect is a closely related ergodic Markov chain. The applicable notions are defined, the underlying quasi-stationary distribution is discussed, and the distribution of the transition count is derived. The maximum likelihood equation for the estimation of a single unknown parameter is examined. Under certain regularity conditions a consistent solution is found to exist which is asymptotically and normally distributed as the number of observations is increased. The results are illustrated by a simulation study of a genetic model describing a fixed size population of gametes of types *a* or *A* in which there is a probability $\alpha$ of a gamete *a* mutating to *A*.
K.W.

**N69-37839#** Sheffield Univ. (England). Dept. of Probability and Statistics.
**THE PRODUCT OF INDEPENDENT BINOMIAL PARAMETERS**
J. B. Garner Dec. 1968 22 p refs
(RR-53/JBG-4) Avail: CFSTI

The problem of finding confidence intervals for the product of independent binomial parameters has been investigated previously from the frequency viewpoint. In that study, the binomial probability mass function was approximated by a normal density function, and an iterative procedure was used in which the approximating normal density changes at each stage. The present article views the problem from a Bayesian viewpoint, gives the exact density function, simple approximations to the density function, and Bayes factor type tests of significance. The problem of comparing two products is also discussed. The exact distribution is a mixture of beta distributions. By using the tables of the incomplete beta function, the relative merits of each approximation are considered for specific numerical examples. Author

**N69-37857#** Basel Univ. (Switzerland). Inst. of Mathematics.
**INVESTIGATIONS ON THE EULER-MACLAURIN SUMMATION FORMULA AND ON NUMERICAL SOLUTION OF POLYNOMIAL EQUATIONS Final Technical Report, 1 Jun. 1967 – 31 Mar. 1969**
Alexander M. Ostrowski Apr. 1969 11 p refs
(Contract DAJA37-67-C-0628)
(AD-688960) Avail: CFSTI CSCL 12/1

A new form for the remainder of the Euler-Maclaurin summation formula is presented, while on the other hand the classical results are generalized in different directions. In particular the results of Jacobi and Malmsten are simplified and improved, introducing the convexity condition. The inequality of G. Gruss given by him for functions of one variable is generalized to most general spaces, introducing the general linear means of functionals in such spaces. On the other hand new bounds for Gruss expression are derived partly in connection with Tchebicheff's inequality. These bounds depend partly on maximum modulus of the derivative and partly on the integral quadratic mean of the derivative. Author (TAB)

**N69-37861#** Wisconsin Univ., Madison. Dept. of Statistics.
**ERROS IN THE FACTOR LEVELS AND EXPERIMENTAL DESIGN. PART 1: A DESIGN CRITERION**
N. R. Draper and W. J. Beggs May 1969 26 p refs
(Contract Nonr-1202(17); Grant NSF GP-7842)
(AD-690133; TR-202) Avail: CFSTI CSCL 12/1

The general situation is examined where there are small disturbances in the predictor variables and a response surface is fitted. A design criterion is suggested to measure the effect of such disturbances. It is proposed that designs be chosen so that this criterion is minimized. Author (TAB)

**N69-37862#** Wisconsin Univ., Madison. Dept. of Statistics.
**ERRORS IN THE FACTOR LEVELS AND EXPERIMENTAL DESIGN. PART 2: THE CASE OF A FIRST ORDER MODEL**
N. R. Draper and W. J. Beggs May 1969 39 p refs
(Contract Nonr-1202(17); Grant NSF GP-7842)
(AD-690134; TR-203) Avail: CFSTI CSCL 12/1

In a previous paper AD-690 133 the general situation when there are small disturbances in the predictor variables and a response surface is fitted, was examined, and a design criterion was suggested to measure the effect of such disturbances. It was proposed that designs be chosen so that this criterion is minimized. In the present paper, this approach is used for the case of first order models, and designs are obtained. Author (TAB)

**N69-37908#** Midwest Research Inst., Kansas City, Mo.
**RATIONAL APPROXIMATIONS TO A CLASS OF G-FUNCTIONS Scientific Interim Report, 1 Jun. 1968 – 1 Feb. 1969**
Jerry L. Fields ARL Feb. 1969 24 p refs
(Contract AF 33(615)-2764)
(AD-689402; ARL-69-0021) Avail: CFSTI CSCL 12/1

Closed form rational approximations are given for the Meijer G-function. In a previous study, the error was formulated by use of differential operators. In the present paper, an error representation based on difference operators is derived. Author (TAB)

**N69-37927#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
**EXTENSION OF AXIOMATIC ANALYTICAL PROPERTIES FOR PARTICLES OF ARBITRARY SPIN AND SUPERCONVERGENT RELATIONS [EXTENSION DES PROPRIETES D'ANALYTICITE AXIOMATIQUES POUR DES PARTICULES DE SPINS QUELCONQUES, ET RELATIONS DE SUPERCONVERGENCE]**
Gilbert Mahoux (Ph.D. Thesis–Paris Univ.) Jul. 1969 77 p refs In FRENCH; ENGLISH summary
(CEA-R-3827) Avail: CFSTI

It is shown that any regularized helicity amplitude, which is known from axiomatic local field theory to satisfy certain disper-

sion relations is in fact analytic in the quasi-topological product. This is an extension to the scattering of spin particles of a result obtained by Martin in the scalar case. As a first consequence, the Froissart limits are extended to all helicity amplitudes. The case of spin 0 - spin 1 scattering is marginal, and in the absence of any detailed dynamical information, one cannot obtain a superconvergent amplitude in that case. Author (ESRO)

N69-37928# Atomic Energy Commission Research Establishment, Risö (Denmark). Electronics Dept.
**AN OPTIMUM COUNT-RATE ESTIMATE FOR A POISSON PULSE TRAIN**
F. Drab (Skoda Works) Mar. 1969 30 p refs
(RISO-M-867) Avail: CFSTI

The method described treats the measurement of a parameter of a Poisson pulse train as a statistical decision, i.e. a hypothesis test which leads to measurement optimization from the point of view of time and accuracy. This method is compared with the existing measurement methods, and a number of possible applications are discussed. Some numerical relations for the symmetrical binary test are developed. Author (ESRO)

N69-37931# Wisconsin Univ., Madison. Mathematics Research Center.
**A NOTE ON THE ASYMPTOTIC NORMALITY OF THE DISTRIBUTION OF THE NUMBER OF EMPTY CELLS IN OCCUPANCY PROBLEMS Summary Report**
B. Harris and C. J. Park Dec. 1968 12 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-689417; MRC-TSR-955) Avail: CFSTI CSCL 12/1

Two elementary proofs of the asymptotic normality of the distribution of the number of empty cells in occupancy problems are provided. Author (TAB)

N69-37943# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
**CONTROL ENGINEERING RESEARCH IN THE DEPARTMENT OF TRANSPORT TECHNOLOGY**
R. J. Aird 1968 8 p Presented at a Res. Seminar., Loughborough, Engl., 20 Nov. 1968
(TT-6904) Avail: CFSTI

An attempt to circumvent artificial barriers of investigation is described in studies of control engineering research by the application of similar techniques to all types of transport modes. Control system analysis is applied by computerized graphics, and a computer program is described consisting of a matrix of points. Manual control systems are in the developmental stage to establish analytically the degree of pilot effort by a measure of physical and mental effort as inferred from statistical analysis of the pilot's frequency response function and the power spectral density of the pilot output. Continuing research in this area requires simulation of supersonic transport aircraft to anticipate differences in the dynamic characteristics of the handling qualities of both jumbo jets and supersonic transports. Three approaches to the application of automatic control are under investigation; these are self-optimizing control, vehicle control, and active suspension systems where both the identification of system parameters producing correction techniques, and centralized computer control of moving parts can produce consistent performance. M.H.E.

N69-37968# RAND Corp., Santa Monica, Calif.
**PROOF OF THE BASIC INVARIANT IMBEDDING METHOD FOR FREDHOLM INTEGRAL EQUATIONS WITH DISPLACEMENT KERNALS, PART 1**
J. Casti and R. Kalaba Jun. 1969 32 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-690125; RM-6037-PR) Avail: CFSTI CSCL 12/1

The report discusses a validation for the invariant imbedding method for the case of a Fredholm integral equation in which the forcing term is an exponential function. Application of the invariant imbedding approach has resulted in various transformations for converting integral equations, two-point boundary-value problems, and variational problems into easily computed Cauchy problems. To consolidate these analytic and computational gains and improve understanding of the associated Cauchy problems, this memorandum proves, conversely, that the solution of the Cauchy problem satisfies the original functional equation. AD-690126, a companion study, completes the validation by offering a proof for the case of a general forcing term G. Author (TAB)

N69-37969# RAND Corp., Santa Monica, Calif.
**PROOF OF THE BASIC INVARIANT IMBEDDING METHOD FOR FREDHOLM INTEGRAL EQUATIONS WITH DISPLACEMENT KERNELS, PART 2**
J. Casti and R. Kalaba Jan. 1969 18 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-690126; RM-6038-PR) Avail: CFSTI CSCL 12/1

The report discusses a validation for the invariant imbedding method for the case of a general forcing term g in the Fredholm integral equation. The theorem developed here begins with the analytic results of AD-690125 (in which the discussion is limited to the case when the forcing term g is an exponential function) and completes the formal validation for initial-value procedures by showing that the solution of a Cauchy problem satisfies the original functional equation. The analytical results of these two studies will be of computational interest in that they add to the feasibility and efficacy of the imbedding approach. Author (TAB)

N69-38081# British Columbia Univ., Vancouver. Dept. of Mathematics.
**THEORY OF ELLIPTIC BOUNDARY PROBLEMS Final Technical Report**
Robert A. Adams, Bui An Ton, Colin W. Clark, and Charles A. Swanson May 1969 11 p refs
(Grant AF-AFOSR-1531-68)
(AD-689424; AFOSR-69-1603TR) Avail: CFSTI CSCL 12/1

Investigations cover the behavior of the eigenvalues of singular linear elliptic operators, with special interest in problems involving unbounded domains and singular coefficients; the problem of determining conditions on an unbounded domain in Euclidean n-space which are necessary or sufficient for the compactness of a Sobolev space imbedding; the existence of solutions of generalized stationary Navier-Stokes equations on a bounded open subset of Euclidean n-space; and study of sufficient conditions for a linear elliptic differential equation to be non-oscillatory in a suitable unbounded domain in n-dimensional Euclidean space. Author (TAB)

N69-38083*# Clemson Coll., S.C. Dept. of Mathematics.
**ON SOLUTIONS OF DIFFERENTIAL AND FUNCTIONAL EQUATIONS Final Report**
T. G. Proctor and H. H. Suber 20 Aug. 1969 121 p refs
(Grant NGR-41-001-018)
(NASA-CR-66833) Avail: CFSTI CSCL 12A

The existence, stability, and computation of periodic and almost periodic solutions of vector differential equations $\dot{x} = Ax + F(x,y)$ and the analogous functional differential equations were studied. The systems were treated as perturbations of the linear system $\dot{x} = Ax$. Emphasis was placed on those cases where the construction of almost periodic solutions leads to a trigonometric series with coefficients in which arbitrarily small divisors occur; methods for the latter were limited to very small perturbations. In many cases, the nonlinear initial value problem $x = f(x,t)$, $x(\tau) = \gamma$ for all $\gamma$ in some region of $R^n$ was solved and then used to compute the almost periodic or periodic solutions of perturbed nonlinear systems. G.S.

**N69-38084#** Sheffield Univ. (England). Dept. of Probability and Statistics.
**ROBUST BAYESIAN ESTIMATION FOR THE MULTINOMIAL WITH APPLICATIONS**
J. B. Gerner Apr. 1969 28 p refs
(RR-60/JB6-7) Avail: CFSTI

A Bayesian method utilizing a nonsymmetrical beta prior was used to investigate point estimates for binomial distribution. The moments of the post distribution of the proportions were examined, and approximate simultaneous interval estimates for the proportions were obtained; nonparametric tests of given quantiles and equality of two populations were than used to formulate a number of numerical examples. It was shown that the use of symmetrical prior was acceptable for the considered cases. G.G.

**N69-38092#** Weibull (Waloddi), Lausanne (Switzerland).
**A GENERAL METHOD FOR ESTIMATING DISTRIBUTION PARAMETERS Summary Report, Apr. 1967 – Apr. 1968**
Waloddi Weibull Wright-Patterson AFB, Ohio AFML Apr. 1969 37 p
(Contract AF 61(052)-843)
(AD-689405; AFML-TR-69-136; SR-8) Avail: CFSTI CSCL 12/1

The method presented is applicable to complete, censored, or truncated samples and to grouped data drawn from any population having a continuous distribution function, simple or composed, involving an arbitrary number of unknown parameters. The estimates are consistent and asymptotically efficient (in some cases for any sample size) and easily determined by use of a versatile computer program. The efficiency can be stated for any individual case, even when only a part of the sample is used for the estimation. Two criteria of goodness-of-fit, which complete each other, make it possible to decide whether the fit attained is acceptable or not. Two of its many applications may be mentioned: the evaluation of data from bending and torsional tests on brittle materials, a problem up-to-now not quite satisfactorily solved due to the complicated distribution functions arising; and the analysis of bimodal fatigue-life distributions. Author (TAB)

**N69-38098#** Northeastern Univ., Boston, Mass.
**THE NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS Final Report, 1 Feb. 1965 – 30 Nov. 1968**
Robert D. Klein and Jack Mettauer 1 Jan. 1969 66 p refs
(Contract AF 19(628)-4779)
(AD-689842; AFCRL-69-0087) Avail: CFSTI CSCL 12/1

The accuracy and stability of several original methods for the numerical solution of the partial differential equations U sub t = (sigma)U sub xx and U sub t = -U(U sub x) are investigated. It is found that by using properly chosen combinations of existing methods it is possible to extend the region of stability beyond the normally accepted limits. The cost of this increased stability is an increased truncation error, which would probably prevent the methods from being of great practical value. A study of the properties of a class of multidimensional difference equations is performed, with results derived concerning their eigenvalues and eigenvectors. The plans for a new computer program system for the solution of global meteorological problems are developed. Author (TAB)

**N69-38147#** Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
**A STUDY OF STATIONARY POINT PROCESSES AND THEIR PASSAGES THROUGH MEMORYLESS SYSTEMS**
James L. Lewis, III and James A. McFadden Jun. 1969 99 p refs
(Contract N00014-67-A-0226; Grant NSF-GE-4732)
(AD-689875; TR-EE69-19) Avail: CFSTI CSCL 12/1

A stationary point process is a sequence of points distributed along the time axis. The locations of these points are governed by probability laws which are invariant under time translation. In the investigation a special class of stationary point processes is defined, called the class with factorable regression. This definition is based on a definition used by Nuttall. For this class the regression function of the cumulative number of points is evaluated in a specific form. Considered as a function of a given number of points in a specified interval, this regression is linear. If a process with a factorable regression is the input to a memoryless system, then the regression is the input of the output with respect to the input is also factorable. Conversely, if the output of a memoryless system has factorable regression with respect to the input, then the input process itself must have factorable regression. The memoryless system is defined by the special requirement that the conditional expectation of the number of output points in a specified interval, given the locations of all the input points, must depend only on the number of input points which have occurred in the same interval. Author (TAB)

**N69-38157#** Society for Industrial and Applied Mathematics, Philadelphia, Pa.
**STUDIES IN NUMERICAL ANALYSIS, PART 1**
1968 138 p refs Presented at AFOSR Symp. in Numerical Analysis at the Natl. Meeting of the Soc. for Ind. and Appl. Math., Iowa City, 11 – 14 May 1966
(Contract AF 49(638)-1689)
(AD-688760; AFOSR-69-1435TR) Avail: CFSTI CSCL 12/1

Contents: The Cauchy problem for the heat equation; Some numerical and mathematical aspects of automating conventional 12-lead electrocardiographic analysis; An analysis of the numerical stability of predictor-corrector solutions of nonlinear ordinary differential equations; A search for optimum methods for the numerical integration of ordinary differential equations; A numerical method for incompressible viscous flow problems in a spherical geometry; Some results on fields of values of a matrix; Uniform approximation theory for integral equations with discontinuous kernels; Today's computational methods of linear algebra. TAB

**N69-38159#** Rutgers Univ., New Brunswick, N.J. Dept. of Mathematics.
**ON THE LAWS OF FREE NILPOTENT GROUPS**
Frant Levin [1969] 14 p refs Submitted for publication Supported by NSF
Avail: CFSTI

If $\underline{N}_c$ denotes the entire variety of every kind of groups nilpotent of class $\leq c$ and $F_k(\underline{N}_c)$ denotes a free nilpotent group of class c and rank k, then the problem is to establish a basis for the laws of $F_{c\cdot 2}(\underline{N}_c)$ which are not the laws of $\underline{N}_c$. The investigation of constructing such laws was resolved by the use of certain associative algebraic representation. Permutation of groups was made leading to a theorem which is related to theorem proof in the case of polynomial identities. The properties of these identities are investigated, a restriction to consider their homogeneous components is made, and it is found that a basis for the laws of $F_{c\cdot 2}(\underline{N}_c)$ is equivalent to determining a Z-basis for W. The theorem is proven by computation of coefficients, the dimensions of W are proven in the corollary, and the demonstrated single law basis is proven both sufficient and unique. M.H.E.

**N69-38178*#** National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
**ESTIMATION OF VARIANCE BY A RECURSIVE EQUATION**
M. Melvin Bruce Washington Oct. 1969 29 p refs
(NASA-TN-D-5465) Avail: CFSTI CSCL 12A

A recursive equation is presented for the purpose of estimation of the variance of a sequence of independent random numbers. The use of this recursive equation makes it possible to perform a running estimate of the variance as the samples are received sequentially. An analysis of the recursive equation is included to show that it gives an asymptotically unbiased estimate of the variance. The variance of the estimated variance is derived for the

special case of random numbers with a Gaussian probability distribution. Author

N69-38188# Los Alamos Scientific Lab., N.Mex.
**COMPARISON OF NUMERICAL QUADRATURE FORMULAS**
David K. Kahaner 17 Jun 1969 13 p refs
(Contract W-7405-ENG-26)
(LA-4137) Avail: CFSTI

Several methods for general purpose numerical quadrature are considered. Selection criteria are total time, including bookkeeping time and function evaluation time, and accuracy of the estimate. The effectiveness of several new methods has been compared with the adaptive Simpson's rule and under certain circumstances at least two of these new methods perform better. Author (NSA)

N69-38197# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
**GENERALIZED ASYMPTOTES FOR EXTREME VALUE DISTRIBUTIONS**
Charles L. Anderson May 1969 32 p refs
(Contract N00014-68-A-0515)
(AD-688409; THEMIS-SMU-TR-34) Avail: CFSTI CSCL 12/1

Some new asymptotic forms for extreme value distributions are given. The family of distributions is called the quadratic type of DNE. It is shown that the sequence of extreme value distributions from a normal distribution is asymptotically attracted to the quadratic type of DNE in a stronger sense, related to Walsh's "Situation J," than the sense in which it is attracted to the linear type of DNE, or first asymptotic type of extreme value distributions, which consists of all distributions of the form exp[- exp[-ax + b]] with a positive. It is also shown that the distribution of the largest value in a sample from a normal population can be approximated rather closely by a distribution in the quadratic type of DNE even when the sample size is fairly small. Various senses of asymptotic attraction and asymptotic equivalence for sequences of distribution functions are discussed and compared re normal and poisson populations. Author (TAB)

N69-38234# Connecticut Univ., Storrs. Dept. of Statistics.
**A QUANTITATIVE APPROACH TO ROBUSTNESS**
Lawrence O. Hatch and Harry O. Posten May 1969 99 p refs
(Contract NONR-3292(03))
(AD-689878; RR-42) Avail: CFSTI CSCL 12/1

The reported research is an attempt to rigorize and quantify the concept of statistical robustness. A brief review of the literature is included and the concept of 'regions of robustness' is presented. Such regions are regions in the space of assumption alternatives within which the user of a statistical procedure is assured that he will make an error in his 'criterion function' of a magnitude no more than a prespecified level. Certain concepts associated with 'regions of robustness' are discussed and various properties of such regions are developed. Finally, four investigations of statistical procedures for testing or estimating population means are presented. Tables are given with each of these investigations which enable the reader to identify regions of robustness of various appropriate levels for any of these procedures. Author (TAB)

N69-38241# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
**A 20-D TABLE OF JACOBI'S NOME AND ITS INVERSE**
Henry E. Fettis and James C. Caslin Mar. 1969 38 p refs
(AD-690115; ARL-69-0050) Avail: CFSTI CSCL 12/1

Jacobi's Nome q is given to twenty decimals as a function of the modulus-squared, k squared, the modular angle arc sin k, and the complementary modulus k' for k squared : 0(.001) .999; arc sin k : 0(.10) 89 degrees (.01) 89.99 degrees (.0002) 90 degrees; k' : 0001(.0001).02. The latter table also gives values of an approximation valid in this range to the order of (k') squared, as well as the ratio of the true and approximate values and second central differences of the latter ratio. The fourth table gives k and k' as functions of q for q = 0(.001).5. Author (TAB)

N69-38274*# Brown Univ., Providence, R.I. Center for Dynamical Systems.
**THE OPTIMIZATION OF TRAJECTORIES OF LINEAR FUNCTIONAL DIFFERENTIAL EQUATIONS**
H. T. Banks and Marc Q. Jacobs [1968] 65 p refs
(Grants NGL-40-002-015; AF-AFOSR-67-089-3A)
(NASA-CR-105973) Avail: CFSTI CSCL 12A

The aim is to examine a number of fundamental questions on the theory of optimal control of processes monitored by certain general systems of linear functional differential equations with finite memories. In the model, the controls may appear in a very general nonlinear functional manner which considers retardations of a rather general character in the control variables. In particular, a maximal principle is proved for such systems. Existence questions in the class of admissible Borel measurable [piecewise continuous, almost piecewise continuous) initial functions and controls are considered. It is also shown that certain solutions of an uncontrolled linear functional differential equation are piecewise analytic or quasi-piecewise analytic. Author

N69-38277# RAND Corp., Santa Monica, Calif.
**THE QUADRATIC VARIATION OF RANDOM PROCESSES**
Percy A. Pierre Jul. 1969 28 p refs
(AD-690272; P-4130) Avail: CFSTI CSCL 12/1

A study is presented of the quadratic variation of the sample functions of random processes having finite fourth moments. The quadratic variation of a function is related to the regular variation and is thus an indicator of the smoothness of the function. Conditions on the fourth moments of the random process are presented which ensure that the quadratic variation is finite and non-zero. In addition the concept of the quadratic variation is generalized to general quadratic functionals of the increments of a random process. These functionals are used to show the relationship between the quadratic variation and the Fourier coefficients of certain random processes. Author (TAB)

N69-38284*# Belov and Associates, Inc., Denver, Colo.
**THE HAMILTON – JACOBI THEORY OF DYNAMICS**
L. Nordheim et al Sep. 1968 72 p refs Transl. into ENGLISH from the publ. "Handbuch der Physik", vol. 5, Chapter 3 Berlin, Springer, 1927 p 91 – 130
(Contract NAS5-10688)
(NASA-CR-105984; Rept-10688-011) Avail: CFSTI CSCL 12A

The theory of integration developed for the differential equations of mechanics is analyzed. The simplest form possible for the differential equations is derived, which leads to the canonical equations of mechanics. Next, the general laws of transformations in which these differential equations retain their form are authorized. This results in the canonical transformations and the theory of their principal invariants. As a last step the actual theory of integration of the canonical equation systems is presented. This encompasses the formation and integration of the Hamiltonian partial differential equation. The limitation of systems with a kinetic potential, such as in celestial mechanics and in atomic theory, is related to the Hamiltonian principle as an actual variational principle. Applications of the calculus of variations in connection with the Hamilton – Jacobi integration process are pointed out. K.W.

N69-38340# Los Alamos Scientific Lab., N.Mex.
**THE METHOD OF ODD/EVEN REDUCTION AND FACTORIZATION WITH APPLICATION TO POISSON'S EQUATION**
B. L. Buzbee, G. H. Golub, and C. W. Nielson 8 Jun. 1969 32 p refs Sponsored in part by NSF

(Contract W-7405-ENG-36)
(LA-4141) Avail: CFSTI

Several algorithms are presented for solving block tridiagonal systems of linear algebraic equations when the matrices on the diagonal are equal to each other and the matrices on the subdiagonals are all equal to each other. It is shown that these matrices arise from the finite difference approximation to certain elliptic partial differential equations on rectangular regions. Generalizations are derived for higher order equations and nonrectangular regions. Author (NSA)

**N69-38405#** Los Alamos Scientific Lab., N.Mex.
**ALTERNATE DIRECTION, DISCRETE ORDINATES METHOD**
Bengt G. Carlson 18 Mar. 1969 7 p refs
(Contract W-7405-ENG-36)
(LA-4072) Avail: CFSTI

A means for combining discrete ordinates techniques for solving the neutron transport equation with an alternating direction form of iteration is developed. It is based on a transformation of the equation, and is meaningful in geometries of more than one space dimension. This method, abbreviated ADDO, has some advantages, at least in theory, probably also in practice, over the currently used discrete ordinates procedures, typified by the DDF code. No numerical comparisons are available yet. Author (NSA)

**N69-38432#** Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
**IDENTIFICATION OF IMPULSE RESPONSE FROM NORMAL OPERATING DATA USING THE DELAY LINE SYNTHESIZER PRINCIPLE**
Rufus Oldenburger and R. C. Desai Jul. 1969 28 p refs
(Contract Nonr-1100(20))
(AD-690218; TR-4) Avail: CFSTI CSCL 12/1

A computational technique is presented for identifying the impulse response of a linear system from normal operating noisy data. No assumption, however, is made regarding the nature of the noise. The technique derives its idea from the delay line synthesizer (DLS) though in this case the DLS coefficients which discretely represent the weighing function are computed automatically employing the steepest descent method. The method has been tried out on a first order as well as a second order system simulated on a digital computer and the estimated impulse response is found to be very close to the actual one. Author (TAB)

**N69-38435#** Watervliet Arsenal, N.Y. Benet R and E Labs.
**MAXIMUM LIKELIHOOD ESTIMATION OF DISTRIBUTION PARAMETERS FROM GENERALLY CENSORED SAMPLES**
Royce W. Seanes, Jr. Jun. 1969 18 p ref
(AD-690185; WVT-6923) Avail: CFSTI CSCL 14/4

A simple derivation of the likelihood function for generally censored samples is given, where 'generally censored sample' connotes: a set of failure data containing both failures and survivors with various different tentative survival times. Author (TAB)

**N69-38467#** Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
**THE DIGITAL MICRODENSITOMETER AS AN OPTICAL SYSTEM COMPONENT**
H. W. Lorber 28 Feb. 1969 49 p refs Sponsored by AEC
Revised
(EGG-1183-1424-Rev; L-927-Rev) Avail: CFSTI

The effects of the sampling operation on the transfer function of an idealized digital microdensitometer are examined, and the respective roles played by input and output filters in the reduction of aliasing and the reconstitution of the sampled output are introduced. The idealization of the model is relaxed slightly so that the scanning aperture can be shown to act as an input filter. The filtering operation performed by the scanning aperture is discussed in more detail, but only in connection with the aperture's effect on supposedly known Fourier components of the input transparency. The notion that a transparency is a sample function of a random process is introduced, and the statistical communication theory of the 1940's is applied in the subsequent discussion. The concepts developed are applied in a quantitative discussion of aliasing phenomena in which some original material is introduced. NSA

**N69-38526#** Los Alamos Scientific Lab., N.Mex.
**SOME INEQUALITY RELATIONSHIPS CONCERNING POWER SUMS AND THE ELEMENTARY SYMMETRIC FUNCTIONS**
Joan H. Hundhausen 7 Nov. 1968 7 p refs
(Contract W-7405-eng-36)
(LA-4051) Avail: CFSTI

Inequality relationships between the power sums and the elementary symmetric functions of a finite set of nonnegative real variables are reduced from consideration of some classical results. Comparability relations between pairs of selected elementary symmetric functions are also demonstrated. Author (NSA)

**N69-38573#** Stanford Univ., Calif. Dept. of Statistics.
**THE ORDER OF A VARIANCE BOUND WHEN ESTIMATING A GENERAL DISCONTINUITY IN DENSITY**
Thomas Polfeldt 28 Mar. 1969 15 p refs
(Contract Nonr-225(72))
(AD-689227; TR-63) Avail: CFSTI CSCL 12/1

A density distribution having a given discontinuity is defined. Based on independent observations, limits of the discontinuity using a variance inequality are given. Estimates for the variance of the discontinuity are suggested as the observations approach infinity. B.G.D.

**N69-38577#** Massachusetts Univ., Amherst. School of Engineering.
**THE FAST FOURIER TRANSFORM AND ITS APPLICATION IN NOISE SIGNAL ANALYSIS**
Robert C. Young Jun. 1969 60 p refs
(Contract N00014-68-A-0146; Proj. Themis)
(AD-689847; Themis-UM-69-6) Avail: CFSTI CSCL 9/4

The fast Fourier transform algorithm is a major advancement in the field of Fourier analysis. It is a versatile method for evaluating Fourier components and is particularly adaptable to the digital computer. This report presents a discussion of the fast Fourier transform and its application in the direct method of power spectrum analysis. A routine is introduced which estimates the first-order linear system through which white noise is introduced to create colored noise. A comparison between the analytical and experimental results is presented. Author (TAB)

**N69-38588#** Sheffield Univ. (England). Dept. of Probability and Statistics.
**A NOTE ON THE 2 TIMES 2 INDEPENDENCE TEST**
J. B. Garner Apr 1969 7 p refs
(RR-58/JBG-5) Avail: CFSTI

The 2 × 2 independence problem is analyzed from the Bayesian point of view. The analysis utilized both population probability and null hypothesis in its review and comparison procedures. E.H.W.

**N69-38591** Washington Univ., Seattle.
**A NOTE ON PRODUCTS OF HOMOGENEOUS TORSION FREE ABELIAN GROUPS**
Rose A. Beaumont [1969] 5 p ref Submitted for publication
Avail: CFSTI

To dispel the existing beliefs that direct products of torsion free groups of rank one and the same type tau is a homogeneous torsion free group of the type tau, theorems and corollaries are

submitted. These sets are members of the Abelian group, and the results indicate the groups are not homogeneous. E.H.W.

N69-38594# California Univ., Los Angeles. Dept. of Mathematics.
**A SHARP SUFFICIENT CONDITION FOR SOLUTION OF A NONLINEAR ELLIPTIC BOUNDARY VALUE PROBLEM**
S. Williams 1969 11 p refs
(Contract Nonr-233(76))
(AD-690556) Avail: CFSTI CSCL 12/1

The paper establishes a sufficient condition such that the equation Au + g(u) = h has a weak solution u with generalized Dirichlet data zero where A is any self-adjoint strongly and uniformly elliptic linear partial differential operator with real-valued, reasonably smooth coefficients defined on a bounded open set Omega of E superscript n, where h is square-integrable and real-valued on Omega, and where g is any continuous real-valued function defined for all real numbers such that g(infinity) = lim as x approaches infinity g(x) and g(minus infinity) = lim as x approaches minus infinity g(x) exist (and are finite) such that g(minus infinity) = or < g(x) = or < g(infinity) for all real x. Author (TAB)

# 20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N69-37218# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
**ESTIMATES OF WIND VARIABILITY BETWEEN 100 AND 900 METERS**
H. H. Monahan, M. Armendariz, and V. D. Lang Apr. 1969 30 p refs
(AD-689437; ECOM-5246) Avail: CFSTI CSCL 4/2

The temporal wind variability between 100 and 900 meters above ground level was estimated from wind measurements made with an Automatic Pilot Balloon Wind Measuring System. One-hundred-gram balloons were released simultaneously from four observational sites on White Sands Missile Range, New Mexico, at six-minute intervals, for a period of 180 minutes on three consecutive days. These data indicate that wind variability increases with increasing time lag, the relationship between wind variability and time lag interval being described by a power curve. In addition, a linear relationship between wind variability and mean wind speed is suggested. Author (TAB)

N69-37241# Naval Research Lab., Washington, D.C. Ocean Sciences Div.
**VERTICAL DISTRIBUTION OF WATER VAPOR OVER WASHINGTON, D.C. DURING 1966 AND 1967, PHASE 1 Final Report**
H. J. Mastenbrook and D. R. Purdy 27 May 1969 99 p refs
(AD-689108; NRL-6891) Avail: CFSTI CSCL 4/1

The vertical distribution of water vapor to stratospheric levels has been measured at monthly intervals over Washington, D. C., during 1966 and 1967. The data for 23 soundings are presented individually in graphs and tables. Author (TAB)

N69-37262# Bergen Univ. (Norway). Geofysisk Institutt.
**FURTHER STUDIES OF STATISTICAL METEOROLOGY, PART 2 Final Report, 1 Jan. 1967 – 31 Dec. 1968**
C. L. Godske, P. Andersen, Th. Jakobsen, and H. Johansen 31 Dec. 1968 85 p refs
(Contract F61052-67-C-0023)
(AD-689190; AFCRL-69-0203) Avail: CFSTI CSCL 4/2

Chapter 1 gives, in addition to general information about administration, travels, etc., a brief report on the influence of grouping in conditional distributions under bimormal conditions. Chapter 2 presents some periodic time series models, to be later applied to meteorological variables. Chapter 3 gives a preliminary report on the spectrum analysis of air temperatures from a network of Norwegian meteorological stations. Chapter 4 deals with the frequency of the West Norwegian weather types (introduced by Johansen) and their application as discriminant functions for meteorological variables. Chapter 5 discusses the statistical weather types, their transition properties and application as discriminant functions. Comparisons are made with H. Johansen's weather types and the type introduced by Hess and Brezowsky for Central Europe. Author (TAB)

N69-37290# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
**METEOROLOGICAL DATA. VOLUME 57, NO. 4: THE CIRCULATION ANOMALY AND DROUGHT IN GERMANY DURING 1947 [METEOROLOGISCHE ABHANDLUNGEN. BAND LXXXVII, HEFT 4: DIE ZIRKULATIONSANOMALIE 1947 UND DIE DUERRE IN DEUTSCHLAND]**
Dieter Nilsette 1969 88 p refs In GERMAN; ENGLISH summary
Avail: CFSTI

The general circulation of the Northern Hemisphere from Nov. 1946 through Oct. 1947 is analyzed in addition to the monthly pressure patterns and pressure deviation charts in order to determine whether the anomalous winter 1946/47 and summer 1947 were caused by an anomalous circulation in the Northern Hemisphere. In general, the zonal circulation was found to have been diminished during the observed period. There was a typical persistence of very high pressure over northern Europe and of very low pressure over the Middle- and East-Atlantic. The reasons for the drought are discussed. The anomalies in the circulation are shown to be a necessary but not a sufficient cause for the catastrophic drought. The importance of the ground climate is discussed in detail. K.W.

N69-37291# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
**METEOROLOGICAL DATA. VOLUME 60, NO. 11: RESULTS OF ASCENTS AT THE RADIOSONDE STATION BERLIN-TEMPELHOF, INSTITUTE FOR METEOROLOGY AND GEOPHYSICS, FREE UNIVERSITY BERLIN, FOR NOVEMBER 1968. DAILY RESULTS AND CLIMATOLOGICAL VALUES AND RESULTS OF SPECIAL ASCENTS [METEOROLOGISCHE ABHANDLUNGEN, BAND XC, HEFT 11: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION BERLIN-TEMPELHOF DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FREIEN UNIVERSITAET BERLIN IM JAHRE 1968 NOVEMBER. TAEGLICHE MESSRESULTATE UND KLIMATOLOGISCHE WERTE, SOWIE MESSERGEBNISSE VON SPEZIALAUFSTIEGEN]**
Richard Scherhag et al 1969 119 p refs In GERMAN; ENGLISH summary
Avail: CFSTI

Detailed daily data for this period are presented in tables and graphs. Using these data, monthly time cross sections of the averaged temperature and the zonal and meridional wind components in heights above 30 km were constructed. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause, and the freezing level. The data of the ozone ascents are given in tabular and graphical form. Author

N69-37292# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
**METEOROLOGICAL DATA. VOLUME 60, NO. 12:**

**RESULTS OF ASCENTS AT THE RADIOSONDE STATION BERLIN-TEMPELHOF, INSTITUTE FOR METEOROLOGY AND GEOPHYSICS, FREE UNIVERSITY BERLIN, FOR DECEMBER 1968. DAILY RESULTS AND CLIMATOLOGICAL VALUES AND RESULTS OF SPECIAL ASCENTS [METEOROLOGISCHE ABHANDLUNGEN. BAND XC, HEFT 12: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION BERLIN-TEMPELHOF DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FREIEN UNIVERSITAET BERLIN IM JAHRE 1968 DEZEMBER. TAEGLICHE MESSRESULTATE UND KLIMATOLOGISCHE WERTE, SOWIE MESSBERGEBNISSE VON SPEZIALAUFSTIEGEN]**

Richard Scherhag et al. 1969 102 p refs In GERMAN; ENGLISH summary

Avail: CFSTI

Detailed daily data for this period are presented in tables and graphs. Using these data, monthly time cross sections of the averaged temperature and the zonal and meridional wind components in heights above 30 km were constructed. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause, and the freezing level. The data of the ozone ascents are given in tabular and graphical form. Author

**N69-37293#** Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.

**METEOROLOGICAL DATA. VOLUME 91, NO. 2: THE HORIZONTAL TEMPERATURE DISTRIBUTION IN URBAN AREAS, PARTICULARLY THAT OF WEST BERLIN DURING COLD CLEAR NIGHTS [METEOROLOGISCHE ABHANDLUNGEN. BAND XCI, HEFT 2: DIE HORIZONTALE TEMPERATURVEILUNG IN GROSSSTAEDTEN, INSBESONDERE DIE WEST-BERLINS IN WINTERLICHEN STRAHLUNGSNAECHTEN]**

Eter Schulze 1969 62 p refs In GERMAN; ENGLISH summary

Avail: CFSTI

The history, methods, and results of previous investigations of urban heat islands are reviewed. This is followed by a description of the measurements in Berlin, conducted from Oct. 1967 through March 1968. A vehicle equipped with two electrical resistance thermometers measuring at a height of 0.2 m and 2.0 m was used. The surveys were made on calm, clear nights without snow. The results are shown on maps and discussed. An average difference of 8.2°C was observed between the inner city and outlying areas.

K.W.

**N69-37373#** Freie Univ., Berlin (West Berlin). Institut fuer Meteorologie und Geophysik.

**METEOROLOGICAL DATA. VOLUME 91, NO. 3: THE DEPENDENCE OF A MAXIMUM NUMBER OF SHOWER-LIKE PRECIPITATION ECHOES ON VARIOUS PARAMETERS AND STABILITY CRITERIA [METEOROLOGISCHE ABHANDLUNGEN. BAND XCI, HEFT 3: UEBER DIE ABHAENGIGKEIT MAXIMALEN ANZAHL SCHAUERARTIGER NIEDERSCHLAGSECHOS VON VERSCHIEDENEN PARAMETERN UND STABILITAETSKRITERIEN]**

Peter Granitzny 1969 78 p refs In GERMAN; ENGLISH summary

Avail: CFSTI

In 180 cases over a period of five years, the relations between daily maximum number of convective radar echoes and values of different vertical stability indices, sea-level pressure, water vapor pressure, vertical extension of convective cells, estimated from radiosonde ascents, and the height of the 0°C level were investigated. No statistical dependence between number of echoes and stability indices was found. As soon as the threshold for instability is exceeded, echo populations between zero and 100, or even more, can be observed within 80 km range. However, with increasing instability, the observed absolute maximum of daily maximum number of echoes increases up to those values of instability indices separating the occurrence of showers and thunderstorms. A statistical dependence was not found unless only cases with the same mean vertical extension of cells, computed from radiosonde ascents, were summarized and the number of cells was plotted versus the height of the 0°C level. In this case, the daily maximum number of convective cells increases with higher freezing level between 550 m and 1050 m, but decreases with further increasing height of freezing level. Additional consideration of isobaric curvature by normalization of the number of echoes to conditions of straight isobars improves the correlation. Author

**N69-37383#** Institut Royal Météorologique de Belgique, Brussels. Inst. d'Hygiène et d'Epidémiologie.

**ATMOSPHERIC POLLUTION, SMOKE AND SULFUR DIOXIDE Monthly Bulletin, Nov. 1968 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX]**

Nov. 1968 21 p In FRENCH and DUTCH

Avail: CFSTI

Tables are given on sulfur dioxide, smoke quantity (air pollution) measured in different weather stations in Belgium in November 1968. A brief description is given of the air sample apparatus.

ESRO

**N69-37395#** Institut Royal Météorologique de Belgique, Brussels. Inst. d'Hygiène et d'Epidémiologie.

**ATMOSPHERIC POLLUTION, SMOKE AND SULFUR DIOXIDE Monthly Bulletin, Dec. 1968 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX]**

Dec. 1968 21 p In FRENCH and DUTCH

Avail: CFSTI

Tables are given on sulfur dioxide, smoke quantity (air pollution) measured in different weather stations in Belgium in December 1968. A brief description is given of the air sample apparatus.

ESRO

**N69-37440#** World Meteorological Organization, Geneva (Switzerland).

**METEOROLOGICAL FACTORS AFFECTING THE EPIDEMIOLOGY OF WHEAT RUSTS**

W. H. Hogg, C. E. Hounam, A. K. Mallik, and J. C. Zadoks 1969 158 p refs

(WMO-238-TP-130; TN-99) Copyright. Avail: Issuing Activity

Wheat rusts (Puccinia spp.) are world-wide in their infestation of wheat and are the cause of serious economic loss annually in the production of this important food crop. As with many other pests and diseases which affect agriculture, there are definite relationships between meteorological factors and the epidemiology of wheat rusts which, if properly understood, might lead to effective warning systems and control measures. The different species of rust are defined and their life cycles are discussed. The possibility of establishing warning systems for rust epidemics is also considered.

Author (ESRO)

**N69-37442** World Meteorological Organization, Geneva (Switzerland).

**MEASUREMENT OF PEAK DISCHARGE BY INDIRECT METHODS**

M. A. Benson 1968 173 p refs

(WMO-226-TP-113; TN-90) Copyright. Avail: Issuing Activity

The discharge of streams is usually measured by the current-meter method. During flood periods, however, it is frequently impossible or impractical to measure the discharges by this method when they occur. Consequently, many peak discharges must be determined after the passage of the flood by indirect methods such as slope-area, contracted opening, flow-over-dam,

flow-through-culvert, rather than by direct current-meter measurement. Indirect methods of determining peak discharge are based on hydraulic equations which relate the discharge to the water-surface profile and the geometry of the channel. A field survey is made after the flood to determine the location and elevation of high-water marks and the characteristics of the channel. Detailed descriptions of the procedures used in collecting the field data and in computing the discharge are given for each of the methods. Author (ESRO)

**N69-37444** World Meteorological Organization, Geneva (Switzerland).
**METHODS IN USE FOR THE REDUCTION OF ATMOSPHERIC PRESSURE**
1968 28 p
(WMO-226-TP-120; TN-91) Copyright. Avail: Issuing Activity

The information received from 107 members shows that one may now generally distinguish between three main categories of pressure reduction methods: a) method based on a formula of Laplace in which the geometric altitude of the station elevation is entered and a correction for humidity is, in most cases, neglected; b) method recommended in technical note No. 61, in which geopotential units are used and a correction for humidity is, in most cases, taken into account; c) other methods which are a mixed variation of the first two or are based on an approximative formula designed for special cases. In the present technical note, countries are listed under one of these categories, according to the method used. The formula of Laplace and the recommended hypsometric equation are described in some detail in the relevant chapters, enabling a ready comparison between these two methods. Author (ESRO)

**N69-37446** World Meteorological Organization, Geneva (Switzerland).
**A NOTE ON CLIMATOLOGICAL NORMALS**
P. Jagannathan, R. Arléry, H. ten Kate, and M. V. Zavarina 1967 26 p refs
(WMO-208-TP-108; TN-84) Copyright. Avail: Issuing Activity

The problem of fixing the optimum length of record for stable climatic statistics is essentially a statistical one and could be solved if the nature of the climatic time-series were known. The length of record available, the homogeneity of the data, the variability of the climatic elements and above all the nature and extent of climatic fluctuations have been the obstacles to a satisfactory solution of this problem. It is very difficult to specify a uniform period to use as a reference period for all the elements which can be adequately representative for the whole world. It would be desirable if monthly and annual climatic statistics could be compiled for every decade uniformly for all countries. These data could be treated as synoptic for purposes of comparison. These decade statistics could be combined according to the requirements of individual research projects. The climatic statistics required for Climat reports should continue to refer to the 30-year reference periods, 1901–30, 1931–60, etc. Author (ESRO)

**N69-37447** World Meteorological Organization, Geneva (Switzerland).
**AIR POLLUTANTS, METEOROLOGY, AND PLANT INJURY**
E. I. Mukammal, C. S. Brandt, R. Neuwirth, D. H. Pack, and W. C. Swinbank 1968 81 p refs
(WMO-234-TP-237; TN-98) Copyright. Avail: Issuing Activity

The susceptibility of different species and even of different varieties of one species of plants to air contaminants may vary considerably. However, surveys have shown that the economic losses, both direct and indirect, caused by air pollution injury to agriculture are extensive and are increasing in many parts of the world. This report reviews the problem and the present state of knowledge in order to assist meteorologists and others concerned in seeking means of preventing or of controlling the extent of such injury. The sources of the various contaminants and their chemical reactions in a contaminated atmosphere are examined in detail and the variations in the susceptibility of plants to air pollution damage as related to meteorological and other factors in the plant environment are described. Also the recognizable symptoms of air pollution injury, giving suggestions for identifying the causative agent and for recognizing similar symptoms produced by other disorders are discussed. Knowledge of the atmosphere's ability to transport and dilute contaminants cannot be applied to air pollution problems without concurrent consideration of pollutant emissions and the biological sensitivity and response characteristics of specific plants. Programs in the prediction of pollutant concentrations, air pollution potential, and pollution damage should be developed. Finally, the general principles involved in collecting and analyzing air samples to determine the nature and concentrations of pollutants are outlined. Author (ESRO)

**N69-37454#** Institut Royal Météorologique de Belgique, Brussels.
**SYNOPTIC OBSERVATIONS [OBSERVATIONS SYNOPTIQUES]**
**Monthly Bulletin, May 1968**
May 1968 31 p In FRENCH and DUTCH
Avail: CFSTI

Synoptic observations made at different stations in Belgium during May 1968 are tabulated. ESRO

**N69-37481#** Weather Bureau, Silver Spring, Md. Technicolor Development Lab.
**AUTOMATIC DECODING OF HOURLY WEATHER REPORTS**
George W. Hollenbaugh, Harry R. Glahn, and Dale A. Lowry Jul. 1969 32 p refs
(WBTM-TDL-21) Avail: CFSTI

A computer program which performs automatic decoding of weather reports is described. The program was designed to be run operationally on the ESSA CDC 8600 computer and includes error detection. Hourly airways data are collected on magnetic tape via the IBM 360-40 computer. Details of the search procedure and decoding of the data are described. A listing of the program is included. Author

**N69-37485#** National Weather Records Center, Asheville, N.C.
**CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET, VOLUME 19: KANSAS CITY, MISSOURI MID-CONTINENT INTERNATIONAL AIRPORT Final Report**
Jun. 1969 32 p ref
(Contract FAA Order FA-67-WAL-129)
(SRDS-RD-69-22-Vol-19) Avail: Issuing Activity

Tabulated data covering the period July 1957 through Dec. 1965 are presented. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated as an aid for making decisions affecting landing systems and fog dissipation at the air terminal. Author

**N69-37501** World Meteorological Organization, Geneva (Switzerland).
**AN AGROCLIMATOLOGY SURVEY OF A SEMIARID AREA IN AFRICA SOUTH OF THE SAHARA**
J. Cochemé and P. Franquin 1967 157 p refs
(WMO-210-TP-110; TN-98) Copyright. Avail: World Meteorol. Organ., Geneva, Switz.: Sw. Fr. 15

An area with a semiarid climate of summer rains in Africa south of the Sahara is delineated and its soils and vegetation briefly described. A simple model of the atmospheric circulation illustrates the origins of its tropical climate with a long dry northern winter and summer rains. Annual crops are cultivated extensively during the rains with graded systems of cultivation adapted to an

increase from north to south of the single annual growing season which is never long enough to permit consecutive cultivation of main crops. The seasonal pattern of rainfall shows a maximum in August. Its variabilities and intensities are somewhat above world average values and, on an annual basis, rainfall per day is about 14 mm throughout the area. Mean annual rainfall increases from 250 mm in the north to 1100 mm in the south, whilst potential evapotranspiration decreases from 2200 mm to 1400 mm. The mean annual 'humid' period, during which rainfall exceeds potential evapotranspiration, increases from nil in the north to 140 days in the south, and the 'moist plus storage' period, corresponding to the season during which annual crops can be grown, increases similarly from 55 to 200 days. Comparison of yield with climatic factors or rainfall and availability of water periods showed that, where there was a marked relation, the regression tended to be curvilinear, with yield dropping off whenever values of the climatic variables exceeded an optimum range, as well as when they fell short of it. Information on yields and the timing of biological events needed for comparisons of agronomic and climatic variables is even scarcer than meteorological information. The type of data required is described in the report. Author (ESRO)

**N69-37518#** Institut Royal Météorologique de Belgique, Brussels.
**CLIMATOLOGICAL OBSERVATIONS [OBSERVATIONS CLIMATOLOGIQUES] Monthly Bulletin, May 1968**
May 1969 15 p In FRENCH and DUTCH
Avail: CFSTI

Climatological data derived from observations made at the Royal Institute for Meteorology, Uccle (Belgium), in May 1969 are given. ESRO

**N69-37541#** Boeing Scientific Research Labs., Seattle, Wash. Geo-Astro Physics Lab.
**AN ON-BOARD TECHNIQUE FOR ESTIMATING THE EFFECTS OF WATER VAPOR IN RADIO OCCULTATION MEASUREMENTS OF ATMOSPHERIC DENSITY**
William G. Tank Feb. 1969 31 p refs Presented at 11th Plenary Meeting of COSPAR, Tokyo, 9 – 21 May 1968
(AD-689033; D1-82-0826) Avail: CFSTI CSCL 4/1

S-band phase path measured between two earth satellites - one in an occultation orbit relative to the other - determines the integrated radio refractivity of the neutral earth atmosphere. Atmospheric density is recoverable from such determinations provided an independent estimate of the contribution of water vapor to integrated refractivity is obtained. Transmission measurements in the vicinity of the 22.235 GHz resonant water vapor absorption line provide this estimate. The data so acquired, moreover, relate to the atmospheric water vapor content integrated precisely over the paths of the phase path measurements. Performed optimally at the frequency of minimum dependence on line width of the water vapor absorption coefficient, the transmission measurement would provide the water vapor estimate to an accuracy of about fifteen per cent; this would result in nearly a tenfold increase in the accuracy of the density data ultimately recovered from the phase path measurements. Phase path could be measured at the optimum frequency for the transmission measurement. A single-frequency system could thus provide all the information necessary for the enhanced density data from the occultation experiment. The satellite system providing such data over regions of the globe lacking standard meteorological observation facilities would constitute a valuable adjunct to the ESSA series of weather satellites. Author (TAB)

**N69-37547** National Lending Library for Science and Technology, Boston Spa (England).
**RADIATION FACTORS IN RECENT CLIMATE CHANGES**
M. I. Dudyko [1969] 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk. Ser. Geog. (Moscow), no. 5, 1969 p 36 – 42 In ENGLISH and partly in RUSSIAN
(NLL-M-7706-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl

Data are given on the secular variation of the earth's temperature and of the radiation reaching the earth's surface, for the period of instrumental observations. The connection between changes of radiation and changes of temperature is examined. A conclusion is reached on the important influences of changes of radiation on contemporary fluctuations of climate. Author

**N69-37648** National Lending Library for Science and Technology, Boston Spa (England).
**ON SOME SPECIAL FEATURES OF CORRELATION ANALYSIS AND THEIR APPLICATION TO WEATHER FORECASTING**
N. A. Bagrov [1969] 16 p refs Transl. into ENGLISH from Glav. Uprav. Gidromet. Sluzh., Met. Gidr. (Leningrad), no. 1, 1968 p 3 – 13 In ENGLISH and partly in RUSSIAN
(NLL-M-7676-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl

The author considers some linear transformations of an initial set of predictors. Expansions in terms of natural orthogonal components in detail are considered, new forms of the regression equation and the square of the multiple correlation coefficient are given. The latter is equal to the sum of the correlation coefficients with the separate natural components. By increasing the number of predictors and increasing the initial volume of data, the problem of the great dispersity of initial information to be used statistically in weather forecasting may be overcome. Additionally, although the present investigation has purely methodological value, it is of great significance in the choice of predictors and procedures for obtaining and estimating significance of both the whole and parts of the regression equation. Author

**N69-37585*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
**CLOUD STATISTICS IN EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS) MISSION PLANNING**
Vincent V. Salomonson Aug. 1969 24 p refs Submitted for publication
(NASA-TM-X-63674; X-622-69-386) Avail: CFSTI CSCL 04B

Available climatological and statistical information is reviewed regarding its contribution to the general objective of the Earth Resources Technology Satellite (ERTS) program. In particular, the frequency of occurrence of cloud-free areas of significant size must be known and the probability of achieving satisfactory measurements estimated in order to optimize the design of the ERTS system. The data sources that can be utilized to augment the reported information are also treated, and problems associated with the interpretation and utilization of the data are outlined. The review shows that a considerable amount of information is currently available, but a large portion of it is not in a form adequate for ERTS mission simulation and planning. Statistics on the frequency of various degrees of cloud cover over the U.S. and the world must be augmented and refined, and more unconditional and conditional cloud cover statistics need to be collected and compiled. Data and pictures from meteorological satellites and the Apollo spacecraft can provide the needed statistics but require careful compilation and standardization due to variations in key factors between the different sources. A.C.R.

**N69-37639#** Max-Planck-Institute fur Chemie, Mainz (West Germany).
**STUDIES OF SIZE DISTRIBUTIONS AND GROWTH WITH HUMIDITY OF NATURAL AEROSOL PARTICLES Final Scientific Report, 1 Nov. 1966 – 31 Dec. 1968**
Nikolaus Abel, Peter Winkler, and Christian Junge Jan. 1969 114 p refs
(Contract AF 61(052)-965)
(AD-689188; AFCRL-69-0205) Avail: CFSTI CSCL 4/2

A sensitive large-ion counter was developed for determination of mobility distributions in natural aerosols at low particle

concentrations in clean atmospheres. Results obtained at mountain stations and on sea are shown. A gravimetric method is described for determination of the growth of aerosol samples in vapors of water and of organic solvents. Experiments with natural and artificial aerosols have been performed to study the form and the hysteresis effect of the growth curve of natural continental aerosols. A solution method was developed for determination of the organic components in natural aerosols. Author (TAB)

N69-37783# Weather Squadron (24th), Detachment 10, Randolph AFB, Tex.
**LYLE STRATUS STUDY FOR FORECASTING GULF STRATUS AT RANDOLPH AFB, TEXAS Final Report**
Richard W. Lyle Jan. 1969 20 p
(AD-688845) Avail: CFSTI CSCL 4/2

Gulf stratus in Texas is defined as a stratus cloud layer formed by a nocturnally cooled gulf air flow. Warm moist air from the Texas Gulf coastal area is cooled to saturation by nocturnal radiation and by adiabatic cooling as it moves upslope from the coast to the five to nine hundred foot elevation of central Texas. Forecasting methods have concentrated primarily on the forecasting of low level moisture and wind flow. Pressure gradient is used rather than wind flow for this study because pressures were thought to be more representative and timely than wind parameters. The 00Z pressure data gave 89% accuracy for occurrence and nonoccurrence of a stratus ceiling at Randolph AFB. Formation of stratus ceilings occurred within one hour and fifteen minutes in 83% of the cases and formed within 300 ft of forecast height in 82% of the cases. Minimum ceilings within 300 ft of forecast occurred in about 65% of the cases. Author (TAB)

N69-37799# Asian Inst. of Tech., Bankok (Thailand).
**SPECTRAL ANALYSIS OF SIMULATED WIND RECORDS INCLUDING TIME-VARYING MEANS AND GUSTS**
Alfredo Fucoy Estoque (M.S. Thesis) 1968 151 p refs *Irs* No. 195
Avail: CFSTI

The general nature of wind is discussed briefly. Pseudo wind records, with time-varying means and including gust effects, are generated on a digital computer to simulate actual wind records as realistically as possible. Portions of actual velocity and vane records of a hurricane are available, for three different elevations during four different periods of the storm, for comparison with the simulated records. The kinetic energy, autocorrelation functions, and energy spectrum for both actual and pseudo winds are compared. It was found that the energy buildup of the simulated wind with a parabolic time-varying mean velocity compares more favorably with the energy buildup of the actual wind, than the simulated wind with a linear time-varying mean. Gusts can also be simulated fairly well with the aid of random numbers. Author

N69-37803 World Meteorological Organization, Geneva (Switzerland).
**THE MEASUREMENT OF ATMOSPHERIC RADIOACTIVITY**
O. Suschny (Intern. Atomic Energy Agency) 1968 117 p refs
(WMO-231-TP-124; TN-94) Copyright. Avail: World Meteorol. Org., Geneva, Switzerland: SW. fr. 30

There is a large selection of counting equipment available for the radioactivity determination, from simple Geiger counters to scintillation spectrometers and semiconductor counters. Special low-background assemblies are available for the measurement of low-level radioactivity. Different combinations of techniques and equipment were found to be in use in different stations in some 30 countries covered by the latest surveys, which were run a few years ago. Some harmonization of these methods and an intercalibration of stations have been tried to render their reported results more useful. Author (ESRO)

N69-37815# Fleet Numerical Weather Facility, Monterey, Calif.
**MONTHLY SURFACE HEMISPHERIC MEANS STANDARD DEVIATIONS, AND DIURNAL VARIATIONS, 1962–1966**
T. S. Hesse and N. M. Stevenson Dec. 1968 331 p refs
(AD-689368; TN-43) Avail: CFSTI CSCL 4/2

Surface pressure analyses on a hemispheric basis have been produced at the Fleet Numerical Weather Central (formerly FNWF) since 1961. These archived analyses, in gridded format on magnetic tape, provide a sample size sufficient to produce useful long term monthly means, standard deviations, and diurnal variations. The method of computation is described, and plotted maps of the monthly mean and standard deviation are presented. The methodology is similar to that used to compute the 500 mb monthly mean maps at FNWC. Author (TAB)

N69-37843# Boeing Co., Renton, Wash. Commercial Airplane Div.
**TEMPERATURE DISTRIBUTIONS ON GREAT CIRCLE AIR ROUTES**
Kurt V. Olsson 1969 78 p refs
(D8-58402) Avail: CFSTI

An accurate method of calculating the statistical monthly and annual distribution of ambient temperatures on Great Circle routes and over geographical regions is presented. An easy to operate computer program gives data in convenient graphical and tabular form for airplane system trade studies and performance calculations. Author

N69-37859# Texas A&M Research Foundation, College Station.
**PREDICTION OF ENVIRONMENTAL PARAMETERS Annual Report, 20 Nov. 1967 – 20 Sep. 1968**
K. C. Brundidge, William H. Clayton, E. L. Deacon, and V. E. Meyer Fort Monmouth, N.J. ECOM Nov. 1968 138 p refs
(Contract DAAB07-68-C-0073; Proj. THEMIS)
(AD-689490; A/M-REF-68-23-A; ECOM-0073-1; AR-1) Avail: CFSTI CSCL 4/2

The research efforts for the first year on Project Themis at Texas A and M University have been directed along five primary research paths: analysis and prediction of atmospheric structure through use of dual-frequency radars and associated ground facilities; cumulus cloud dynamics; modeling studies of the frictional boundary layer; installation of two automatic meteorological collection stations in an instrumented watershed which is in the pattern of the radars; and design of a facility for direct measurement of the fluxes of momentum, heat, and vapor. The activities under these various headings are reviewed seperately herein. Author (TAB)

N69-37880# New Mexico Univ., Albuquerque. Dept. of Physics and Astronomy.
**STUDIES OF ATMOSPHERIC OZONE Final Report, 15 Mar. 1966 – 31 Dec. 1968**
Victor H. Regener and Luis Aldaz 15 Mar. 1969 171 p refs
(Contract AF 19(628)-5934)
(AD-689813; AFCRL-69-0138) Avail: CFSTI CSCL 04/1

The final report contains three papers entitled 'turbulent transport near the ground as determined from measurements of the ozone flux and the ozone gradient' by Victor H. Regener and Luis Aldaz; 'Flux Measurements of Atmospheric Ozone over Land and Water' by Luis Aldaz; and 'Folded Optical Path of Great Length from Multiple Reflections Between Two Corner Cube Reflectors' by Victor H. Regener. The report also contains 206 computer-plotted graphs showing profiles of ozone, temperature and wind in the first 16 meters above the surface. These graphs contain a total of 382 profiles which were obtained on 37 days from December 22, 1966 to April 2, 1968. Author (TAB)

N69-37933# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
**THE ATTENUATION AND BACKSCATTERING OF**

**INFRARED RADIATION BY ICE FOG AND WATER FOG**
Motoi Kumai and Jack Russell Apr. 1969 14 p refs
(AD-689447; CRREL-RR-264) Avail: CFSTI CSCL 4/2

Ice-fog crystals consisting of many spherical particles, and some hexagonal plates and columns, were observed at ambient temperatures of about -40C in the Fairbanks, Alaska, area during mid-winter. The concentrations and the size distributions of the ice-fog crystals were measured. The attenuation and backscattering of infrared radiation by ice-fog crystals were computed for optical wavelengths of 2.2 microns, 2.7 microns, 4.5 microns, 5.75 microns, 9.7 microns and 10.9 microns using the Mie theory. The minimum attenuation coefficients and backscattering functions of ice fog were found to be at 9.7 microns wavelength in the observed wavelengths. Optical attenuation coefficients and volume backscattering functions of water fogs were also computed using the Mie theory. The minimum attenuation coefficients and backscattering functions of water fog were found to be at 10.9 microns wavelength in the region of 2.2 microns, 2.7 microns, 4.5 microns, 5.75 microns, 9.7 microns and 10.9 microns. Both the attenuation coefficients and backscattering functions of ice fog are within the same order of magnitude as water fog for equivalent fog concentrations and wavelengths. Author (TAB)

**N69-37934#** Army Cold Regions Research and Engineering Lab., Hanover, N.H.
**FOG MODIFICATION STUDIES ON THE GREENLAND ICE CAP**
Motoi Kumai Mar. 1969 16 p refs
(AD-689448; CRREL-RR-258) Avail: CFSTI CSCL 4/2

During the summer of 1965, the CRREL cloud physics group carried out a study of fog modification by propane and dry ice seeding on the Greenland Ice Cap, an area with one of the lowest concentrations of atmospheric pollution on earth. The nuclei of supercooled fog droplets before seeding were observed using electron microscopy and electron diffraction methods. The nuclei of ice crystals formed by dry ice and propane seeding were also observed using the same technique. The nuclei of the supercooled fog droplets and the ice crystals formed by seeding were found to be hygroscopic sea salt particles that were easily distinguished from the clay mineral nuclei of natural snow crystals. The sublimation temperature of carbon dioxide is -78.5C. The boiling point of liquid propane is -44.5C at 1 atm pressure. It is concluded that the ice nucleation of supercooled fog by dry ice and liquid propane seeding is due to thermal effects. Author (TAB)

**N69-37988*#** Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
**PEAK WIND STATISTICS ASSOCIATED WITH THUNDERSTORMS AT CAPE KENNEDY, FLORIDA**
E. A. Carter and L. A. Schuknecht NASA. Marshall Space Flight Center Aug. 1969 28 p refs
(Contract NAS8-20082)
(NASA-CR-61304; LMSC/HREC-D149129; TM-54/50-131) Avail: CFSTI CSCL 04B

Eleven years of Cape Kennedy, Florida hourly peak wind speeds and hourly surface weather observations are analyzed to determine the risks of wind speeds exceeding critical values in any month at Cape Kennedy. The mean and standard deviations of the peak wind occurrences, categorized as thunderstorm and non-thunderstorm, are fitted to a Fisher - Tippet Type I distribution to show the probability of peak wind speeds ≤ any selected value. Results for July indicate that there is a 99% chance that the peak wind speed will be ≤ 38 knots on any given day. However, if it has been predicted with reasonable assurance that a thunderstorm will occur, there is then a 97.5% chance that the peak wind will be ≤ 38 knots and a 99% chance that it will be ≤ 43 knots. Author

**N69-37972#** Sperry Rand Research Center, Sudbury, Mass.
**A STUDY ON SOME EQUIPMENT AND ENVIRONMENTAL PARAMETERS AFFECTING AIRBORNE REMOTE PROBING OF TEMPERATURE AND PRESSURE PROFILES Final Report, 15 Mar. - 15 Nov. 1968**
Wayne D. Mount, Richard B. Fow, and Charles M. Maloy Mar. 1969 84 p refs
(Contract F19628-68-C-0295)
(AD-689410; SRRC-CR-69-9; AFCRL-69-0168) Avail: CFSTI CSCL 4/2

The physical and mathematical bases of remotely probing temperature and pressure profiles from an aircraft using a microwave radiometer are presented. The results of the previous study of this problem in which its feasibility was determined are reviewed. Instrumental effects are considered and are shown to be less of a problem than was originally anticipated, with the possible exception of the problems induced by tuning uncertainties. The effect of season, latitude, and the underlying surface on the feasibility of remote probing are investigated using a simple linear inversion scheme. It is shown that seasonal and latitudinal effects do exist, but can be minimized. The effects of the underlying surface pose problems below 500 mb. A technique for determining the tropopause and the temperature conditions above it are described. In general, there are no environmental or equipment considerations that adversely affect our ability to remotely measure the temperature and pressure-height profile between the 100 and 500 mb level. Author (TAB)

**N69-37991#** Institut Royal Météorologique de Belgique, Brussels. Régie des Voies Aériennes et Force Aérienne.
**SYNOPTIC OBSERVATIONS [OBSERVATIONS SYNOPTIQUES] Monthly Bulletin, Jul. 1968**
1969 29 p In FRENCH and DUTCH
Avail: CFSTI

Synoptic data from different Belgian weather stations during July 1968 are tabulated. ESRO

**N69-37996#** Institut Royal Météorologique de Belgique, Brussels. Régie des Voies Aériennes et Force Aérienne.
**SYNOPTIC OBSERVATIONS [OBSERVATIONS SYNOPTIQUES] Monthly Bulletin, Jun. 1968**
1969 27 p In FRENCH and DUTCH
Avail: CFSTI

Synoptic data from different Belgian weather stations during June 1968 are tabulated. ESRO

**N69-38005#** Institut Royal Météorologique de Belgique, Brussels. Régie des Voies Aériennes et Force Aérienne.
**SYNOPTIC OBSERVATIONS [OBSERVATIONS SYNOPTIQUES] Monthly Bulletin, Aug. 1968**
1969 29 p In FRENCH and DUTCH
Avail: CFSTI

Synoptic data from different Belgian weather stations during August 1968 are tabulated. ESRO

**N69-38082#** Bonn Univ. (West Germany). Inst. of Meteorology.
**CROSS SPECTRUM AND FILTER ANALYSIS OF MONTHLY RAINFALL AND WIND DATA IN THE TROPICAL ATLANTIC REGION Final Technical Report, Oct. 1967 - Apr. 1968**
Rolf Doberitz Apr. 1969 58 p refs
(Contract DAJA 37-67-C-0681)
(AD-689482) Avail: CFSTI CSCL 4/2

Series of rainfall, wind components, sea surface temperature (monthly data) of the tropical Atlantic Ocean were subjected to cross spectrum and filter analyses. Main interest was directed to teleconnections and phase relationships (time lags) of the annual cycle and to long-term fluctuations (periodicities between one and ten years). The following statistical results are discussed in detail: spectra, filtered series (e.g. biennial pulse), coherency, and phase differences. The behavior of the biennial cycle and some other

results are compared with those of the equatorial Pacific region.
Author (TAB)

N69-38102# Environmental Technical Applications Center (Air Force), Washington, D.C.
**US NAVAL WEATHER SERVICE WORLD-WIDE AIRFIELD SUMMARIES. VOLUME 8. PART 2. UNITED STATES OF AMERICA (ROCKY MOUNTAINS AND NORTHWEST BASIN)**
Jun. 1969 614 p refs
(AD-689792) Avail: CFSTI CSCL 4/2

The volume is part of a series of compilations which is world-wide in scope. It consists of climatological summaries for selected airfields and for the climatic areas in which they are located.
Author (TAB)

N69-38106# Weather Squadron (8th), Detachment 15, Ramey AFB, Puerto Rico.
**TERMINAL FORECAST REFERENCE FILE, VOLUME 1**
Jun. 1969 57 p
(AD-689779) Avail: CFSTI CSCL 4/2

The report is a reference file for forecasters. Contains a description of the local area climatology, weather regimes, rules of thumb, and forecast studies.
Author (TAB)

N69-38118# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
**NOTE ON THE THEORY OF GROWTH OF CLOUD DROPS BY CONDENSATION**
R. C. Srivastava 9 Jun. 1969 16 p refs Sponsored in part by United Airlines Found. Prepared in cooperation with IIT Res. Inst., Chicago, Ill.
(Grant NSF GA-10639)
(TR-11) Avail: Issuing Activity

The effect of a random distribution of cloud drops on the development of their size distribution by condensation is discussed. By consideration of a one-dimensional analog and physical arguments it is conjectured that the rate of growth of a cloud drop by condensation may be taken as proportional to the volume of air occupied by the drop. On the basis of this conjecture an equation is derived for the size distribution of cloud drops. This distribution agrees well with drop size spectra observed in fair weather cumuli.
Author

N69-38124# Weather Bureau, Silver Spring, Md. Techniques Development Lab.
**AN OPERATIONALLY ORIENTED OBJECTIVE ANALYSIS PROGRAM**
Harry R. Glahn, George W. Hollenbaugh, and Dale A. Lowry Jul. 1969 24 p refs
(WE-TM-TDL-22) Avail: CFSTI

A computer program which performs objective analyses of sea-level pressure and saturation deficit by the method of successive approximations is described. The program was designed to be run operationally and includes error detecting routines. Analyses of hourly airways data collected on magnetic tape are made on a 39 × 40 grid over the eastern and central U.S. The small-scale detail specified by the relatively dense observations is retained with a grid-length of about 50 miles. Details of the error-detecting, correction, and smoothing procedures are described. A listing of the program is included.
Author

N69-38170# Wisconsin Univ., Madison. Dept. of Soil Science.
**ANEMOCLINOMETER MEASUREMENTS OF REYNOLDS STRESS AND HEAT TRANSPORT IN THE ATMOSPHERIC SURFACE LAYER Final Report, Oct. 1965 - Jan. 1969**
Champ B. Tanner and George W. Thurtell Ft. Huachuca, Ariz. ECOM Apr. 1969 200 p refs
(Contract DA-AMC-28-043-66-G22)
(AD-689487; ECOM-66-G22-F) Avail: CFSTI CSCL 4/2

A small, three-dimensional pressure-probe anemometer (IMFL anemoclinometer) was used to measure the three components of the wind vector, shear stress, and the ratio of the standard deviation of the vertical wind to the friction velocity as influenced by atmospheric stability. Horizontal wind and shear stress have been compared with independent wind profile and shear stress meter measurements. The anemometer was coupled with a fast thermometer for eddy correlation measurements of sensible heat flux and with a fast hygrometer for measurements of latent heat flux. The eddy correlation measurements of sensible and latent heat fluxes were compared with independent energy balance, wind profile, and sonic anemometer-thermometer measurements.
Author (TAB)

N69-38200# Freie Univ., Berlin (West Germany). Institut Fuer Meteorologie Und Geophysik.
**DAILY AND MONTHLY NORTHERN HEMISPHERE 30 MILLIBAR. SYNOPTIC WEATHER MAPS OF THE YEAR 1966. PART 3 Quarterly Technical Status Report, Jul. - Sep. 1966**
Barbara Krister, Karin Labitzke, Richard Scherhag, and Karl Sieland 1967 114 p
(Contract DA-91-591-EUC-4043)
(AD-689509; QTSR-3) Avail: CFSTI CSCL 4/2

The report is part of a series of synoptic weather charts of the upper atmosphere begun in 1966. The report contains: the method of analysis - the circulation at the 5 millibar surface and a comparison with the 10 millibar surface - mean monthly maps and daily synoptic weather maps.
Author (TAB)

N69-38220*# Lockheed-California Co., Burbank.
**MATHEMATICAL WIND PROFILES. PARTS 1 - 4**
Arnold Court, Robert R. Read, and Gerald E. Abrahms Huntsville, Ala. NASA Marshall Space Flight Center 20 May 1969 112 p refs
(Contract NAS8-5380)
(NASA-CR-61282; NASA-CR-61195; Rept-17683; Rept-18734; Rept-18989; Rept-19128) Avail: CFSTI CSCL 04B

Augmented complex Fourier polynomials, in which constant and linear terms are added to a Fourier series for a complex variate, are developed to represent a hodograph. They are applied to hodographs representing the projection, on a horizontal plane, of the wind at equal intervals in the vertical, and hence to describe the vertical profile of horizontal wind velocity. Seasonal differences, differences between the velocity and momentum representations of the wind, length and specific interval in a sounding, and the effect of averaging and normalizing on a profile are discussed, with 11 tables based on two 34-km soundings and two sequences of 6-hourly soundings. Serially complete 6-hourly wind observations from the surface to 27-km are used to compute 5200 serial correlations of wind integrated over 7-km layers. Criteria for wind profile predicting are formulated from these correlations, for four representations of the wind, four atmospheric zones and their sum, thirteen calendar intervals, and four time lags. Properties of the augmented complex Fourier polynomials are summarized, and detailed procedures are developed for predicting a future vector wind profile from present and past profiles.
Author

N69-38267# Weather Bureau, Salt Lake City, Utah.
**WEATHER EXTREMES**
Robert J. Schmidli, comp. Dec. 1968 48 p Revised
(WBTM-WR-28-Rev.) Avail: CFSTI

Tabulated data for the entire mountainous area of the western United States are presented. The tables are organized so that the extremes of a given element are listed on a single page for cities, states, etc., followed by listing of multiple element extremes for specific locations and areas.
A.C.R.

N69-38283# National Severe Storms Lab., Norman, Okla.
**DETECTION AND PRESENTATION OF SEVERE**

**THUNDERSTORMS BY AIRBORNE AND GROUND-BASED RADARS: A COMPARATIVE STUDY**
K. E. Wilk, J. K. Carter, and J. T. Dooley Feb. 1969 63 p refs
(ERLTM-NSSL-43) Avail: CFSTI CSCL 04B

Observations of severe thunderstorms by a WSR-57 radar are compared with PPI displays obtained simultaneously with Collins X- and C-band, and Bendix K sub a-band airborne radars, and with the ARSR-ID air traffic control radar used by the FAA. Reflectivity estimates based on the S-band WSR-57 radar are used to evaluate the effects on core measurements by intervening precipitation. Problems of beam aspect and flight altitude are discussed in relation to the storm reflectivity profiles encountered during the test flights. Comparative presentations are analyzed in detail for three of the storms investigated, and examples of contour mapping and lightning detection with the ARSR-ID radar are given.
Author (USGRDR)

**N69-38317#** Library of Congress, Washington, D.C. Aerospace Technology Div.
**COMMUNIST-BLOC METEOROLOGICAL SYSTEMS AND SENSORS**
Lee Boylan Jun. 1969 90 p refs
(AD-689767; ATD-69-54) Avail: CFSTI CSCL 4/2

Contents: Automatic weather station technology; Data handling; Information processing; and Instruments and components.
TAB

**N69-38392#** Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
**AN EXPERIMENTAL STUDY TO DETERMINE THE UTILITY OF STANDARD COMMERCIAL HOT-WIRE AND COATED WEDGE-SHAPED HOT-FILM PROBES FOR MEASUREMENT OF TURBULENCE IN WATER CONTAMINATED AIR FLOWS, PART 2**
J. Francis Mercaret, Jr. Feb. 1969 58 p refs
(Contract Nonr-4010(11))
(AD-689140; TR-50; REF-69-3) Avail: CFSTI CSCL 4/2

Experiments were performed with the DISA 55D05 constant temperature anemometer and 55A8 hot-film probe under simulated field conditions. Procedures supplemental to the manufacturer's recommendations were developed for simplifying the operation of the equipment. The response in this configuration to water droplet impact was investigated. In addition a study of the noise and expected atmospheric signal plus noise to noise ratio as a function of frequency, flow parameters, and system variables was conducted. It is concluded that the system can provide useful turbulence measurements, for example, those appropriate to the study of energy dissipation in storms, even in the presence of heavy rain.
Author (TAB)

**N69-38416#** Scientific Translation Service, Ann Arbor, Mich.
**METEOROLOGICAL STUDIES OF TURBULENT DIFFUSION IN THE ATMOSPHERE**
G. Polster 1969 18 p Transl. into ENGLISH from the German Prepared for Oak Ridge Natl. Lab.
(ORNL-TR-2109) Avail: CFSTI

The effects of strong warm air advection, cold air advection, and sinking processes and advection on the natural radioactivity emission from the earth were evaluated. Intensified turbulence was found in the fields of fronts and in cold air flows; weakened turbulence in warm air currents outside of front fields; phase shifts in the diurnal variation and at wind speed maxima under inversions, a type of low-level jet was detected. Turbulent diffusion in the atmosphere depends on many influences most of which are superimposed although at times, they predominate individually. Comparative measurements and observation are needed to evaluate different influences.
NSA

**N69-38434#** Weather Squadron (8th), Detachment 4, Loring AFB, Maine.
**TERMINAL FORECAST REFERENCE FILE, VOLUME 1**
Jun. 1969 71 p
(AD-689778) Avail: CFSTI CSCL 4/2

The report is a reference file for forecasters containing a description of the local area, climatology, discussion of weather regimes, rules of thumb and forecast studies.
Author (TAB)

**N69-38454#** National Weather Records Center, Asheville, N.C.
**CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET, VOLUME 20: LOS ANGELES, CALIFORNIA INTERNATIONAL AIRPORT Final Report**
Jun. 1969 33 p refs
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-20) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Los Angeles International Airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the terminal.
Author

**N69-38455#** National Weather Records Center, Asheville, N.C.
**CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET, VOLUME 21: LOUISVILLE, KENTUCKY STANDIFORD FIELD Final Report**
Jun. 1969 33 p refs
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-21) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Louisville Standiford Field Airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the terminal.
Author

**N69-38456#** National Weather Records Center, Asheville, N.C.
**CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET, VOLUME 22: MIAMI, FLORIDA INTERNATIONAL AIRPORT Final Report**
Jun. 1969 33 p refs
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-22) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Miami International Airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the terminal.
Author

**N69-38518#** Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
**RESULTS OF A PRELIMINARY FIELD STUDY OF WAVE GENERATION BY WIND**
John R. Seesholtz and Erik Mollo-Christensen Jan. 1969 27 p refs
(Contract Nonr-1841(74); Grant NSF GA-4321)
(AD-689870; Rept-69-1) Avail: CFSTI CSCL 8/3

Observations made from a thirty meter tall spar buoy are described. Wind velocity profiles, atmospheric pressure fluctuations and wave profiles were recorded and means, spectra and covariances of the observed quantities were evaluated. Comparison of the observed rate of change of wave energy with theoretical

predictions shows only fair agreement with Miles' theory. The phase lead of wind fluctuations with respect to the wave crests increased with height, the maximum near the critical layer. Author (TAB)

N69-38550# Weather Squadron (15th), Detachment 24, Norton AFB, Calif.
**TERMINAL FORECAST REFERENCE FILE**
Wilson H. Mc Millan Mar. 1969 112 p Revised
(AD-689179) Avail: CFSTI CSCL 4/2

The reference file discusses factors affecting the weather at Norton AFB, CA. Included are location and topography, weather controls, climatic aids and local forecast studies. Author (TAB)

# 21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-37204# ITT Avionics, Nutley, N.J.
**TACAN BEARING-DISTANCE MEASURING EQUIPMENT Final Report**
D. I. Merritt Dec. 1968 147 p refs
(Contract FA-64-NA-5144)
(AD-688824; SRDS-RD-69-10) Avail: CFSTI CSCL 17/7

A program was conducted to design and develop a feasibility model of a Tacan Bearing-Distance Measuring Equipment for use in an improved navigational aid flight inspection system, referred to as SEAL (Signal Evaluation Airborne Laboratory). The purpose of the Tacan portion of the flight inspection system is to evaluate the quality of a signal emanating from a selected Tacan ground facility. This purpose is accomplished by use of a highly accurate Tacan Bearing-Distance Measuring Equipment such that the data obtained is representative of the characteristics of the radiated signal. In-flight monitoring and recording of the data permits subsequent data reduction and computation of the quality of the Tacan signal to a high degree of accuracy. The design consists of independent bearing and distance measuring equipments, providing for simultaneous data collection and position updating. Author (TAB)

N69-37706*# Control Data Corp., Minneapolis, Minn. Edina Space and Defense Systems.
**SELF-CONTAINED NAVIGATION EXPERIMENT Final Report**
10 Jul. 1969 228 p refs
(Contract NAS5-9683)
(NASA-CR-105920; RD-2009) Avail: CFSTI CSCL 17G

Presented are results and conclusions of a series of experiments conducted for a self-contained navigation system. The system, consisting of a flight model star sensor and auxiliary ground based data processing equipment, utilized star field mapping techniques in its experiments. Experiments were operated successfully for the determination of attitude, and useful data were obtained in full daylight when scanning motion of the satellite directed the optical axis away from the sun. Automatic reduction of the telemetered data, including star identification and attitude computation, was accomplished. Difficulties were experienced in obtaining the precision required to calculate orbital parameters from an ejected sphere. Satellite orbital position computed from moon transits was determined within an error band from −50 to +40 kilometers. Standard deviations are also included. Author

N69-38017*# Massachusetts Inst. of Tech., Cambridge. Experimental Astronomy Lab.
**OPTIMUM MIXING OF INERTIAL NAVIGATOR DATA AND RADAR DATA**
Michel Claude Brevard (M.S. Thesis) Jun. 1969 94 p refs
(Contract NAS12-2081)
(NASA-CR-86235; TE-29) Avail: CFSTI CSCL 17G

The filtering problem is studied for a system composed of an inertial navigation system (INS) giving continuous indication of position and velocity, and a radar or some other external device giving continuous or discrete positional information. After a review of the filtering theory using the state variables representation, an error analysis yields three different mathematical models for the INS, represented by a set of linear differential equations. The equations for both the continuous and the discrete filtering schemes are derived, assuming the only error sources are a white noise at the acceleration level in the INS and a white or Gaussian (in the discrete measurement mode) noise in the radar. Functional relations are obtained between the position and velocity root mean square errors and the following characteristic quantities: noises in both the INS and the radar, and operating time (time between the measurements) for the discrete filter scheme. Author

N69-38041*# Ohio State Univ., Columbus, Ohio.
**TECHNIQUES FOR GENERATION OF CONTROL AND GUIDANCE SIGNALS DERIVED FROM OPTICAL FIELDS**
H. Hemami, M. B. Kuhnjr, and L. T. Bashark, Washington, NASA Oct. 1969 72 p refs
(Grant NGR-36-008-076)
(NASA-CR-1443; RF-2421) Avail: CFSTI CSCL 17G

A general transfer functional is derived for optical systems that relates the image intensity to the spatial autocorrelation of the aperture and temporal autocorrelation of the received signals. A simple method of detection of star images by cross-correlation techniques is developed. This cross-correlation requires certain image density characteristics that can be constructed by appropriate prefiltering of the signals. Synthesis of a class of such filters is carried out in a sequence of experiments, and the feasibility and performance of the filters are discussed. Two methods of estimating the position of the star image are developed and their implications discussed. One method is based on generalized mean square error criterion and requires prefiltering and full knowledge of the star image intensity. For the second method partial knowledge about the star image is sufficient. Author

# 22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N69-37225*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
**A SIMPLE METHOD FOR DETERMINATION OF FISSION GASES TRAPPED IN IRRADIATED FUEL FORMS**
Dean W. Shelbley Washington Oct. 1969 9 p refs
(NASA-TM-X-1883) Avail: CFSTI CSCL 18J

A simple, rapid, safe, quantitative method for determining fission gases trapped in Mo-$UO_2$ and W-$UO_2$ cermets is described. The method uses electrolytic dissolution of the cladding and matrix, and acid dissolution of the fuel. The gaseous activity is collected in charcoal collection vials at liquid-nitrogen temperature. Recovery is greater than 98 percent. Fission gas activity is determined by gamma counting the gas-collection vials. The explosion hazard due to the electrolytic production of hydrogen and oxygen is eliminated. The accuracy of the method is ±2.5 percent (standard deviation) at $10^5$ disintegrations per minute. Author

N69-37231# Idaho Nuclear Corp., Idaho Falls. Nuclear and Chemical Technology Div.
**EXPERIMENTAL FACILITIES, TECHNIQUES, AND INSTRUMENTATION**
*In its* Nucl. Technol. Branch Dec. 1968 p 181-316 refs (See

N69-37226 22-24)
Avail: CFSTI

Operational systems and instrumentations for research and test reactors described range from computerized control and display systems to the design and performance of radiation detectors and fission monitors. Emphasis is placed on the utilization of lithium drifted silicon sensors. NSA

**N69-37360#** Argonne National Lab., Ill.
**VOLATILITY STUDIES WITH IRRADIATED FUELS**
A. A. Chilenskas *In* Dow Chem. Co. Fluoride Volatility 1968 p 63 - 64 refs (See N69-37355 22-06)
Avail: CFSTI

The results of the ANL experimental work with irradiated uranium alloy fuels and irradiated $UO_2$ fuels were summarized. The removal of uranium and plutonium from the fluid-bed reactor was comparable to the removals found in studies using nonirradiated fuel materials and at levels satisfactory for process economy. The decontamination factors for the uranium metal alloy fuels were sufficiently high such that the major gamma activity for processed 90 day cooled fuel was from U-237. Several simple schemes were tested for the decontamination of the plutonium recovered from irradiated $UO_2$. For a simple volatilization separation of plutonium hexafluoride from the fluid-bed, a decontamination factor from gross gamma of 120 was obtained. When a sublimation step and thermal decomposition step were added to the volatilization separation, an improvement in gross gamma decontamination factor to $3.2 \times 10^3$ was obtained. The major gamma activity which followed the plutonium in each case was ruthenium. Author

**N69-37361#** Argonne National Lab., Ill.
**DEVELOPMENT OF VOLATILITY PROCESSES FOR THERMAL AND FAST REACTOR FUELS**
A. A. Jonke *In* Dow Chem. Co. Fluoride Volatility 1968 p 65 - 78 (See N69-37355 22-06)
Avail: CFSTI

Potential and present applications for the fluoride volatility process are listed and discussed. These include the reprocessing of low-enrichment, high-enrichment, fast breeder, and light water, and LMFBR reactor fuels. NSA

**N69-37362#** Dow Chemical Co., Golden, Colo. Rocky Flats Div.
**A FLUIDIZED-BED FLUORIDE VOLATILITY PILOT PLANT FOR PLUTONIUM PURIFICATION**
R. L. Standifer *In its* Fluoride Volatility 1968 p 79 - 98 (See N69-37355 22-06)
Avail: CFSTI

The design and performance of a gram quantity static bed volatility system for purifying scrap plutonium from weapons production process and recovering plutonium from residues generated in the process are described. Experiments were started in December 1967. Current plans call for completion of a production prototype system by January 1970, and assuming continued favorable results, incorporation of a volatile fluoride process in a new plutonium recovery facility around 1974. NSA

**N69-37363#** Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
**THE OAK RIDGE GASEOUS DIFFUSION PLANT FUEL REPROCESSING PROGRAM**
J. R. Merriman and J. H. Pashley *In* Dow Chem. Co. Fluoride Volatility 1968 p 99 - 129 refs (See N69-37355 22-06)
Avail: CFSTI

Experimental efforts have been primarily keyed to process areas where large-scale testing or hardware development was considered necessary to provide bases for the design of full-size reprocessing plants. This work included semi-works processing of simulated fuel assemblies, i.e., hydrochlorination, oxidation, and fluorination of Zircaloy-clad uranium dioxide in a large fluid-bed reactor system; recycle compressor development and testing; corrosion studies; testing of valves, connectors, samplers, and filters; and investigations of the consequences of bromine pentafluoride spills. Author

**N69-37366#** Dow Chemical Co., Golden, Colo. Rocky Flats Div.
**CRITICALITY CONSIDERATIONS IN FLUORIDE VOLATILITY PROCESSING**
C. L. Schuske *In its* Fluoride Volatility 1968 p 161 - 165 (See N69-37355 22-06)
Avail: CFSTI

The effects of density, moisture, personnel shielding, and geometry on critical mass and dimension in critical mass and dimension in criticality measurements on $^{239}Pu$ in fluoride volatility processing are discussed. Ideas that may be used to minimize restrictions for process equipment and result in practical dimensioned process equipment are included. NSA

**N69-37368#** Dow Chemical Co., Golden, Colo. Rocky Flats Div.
**ENGINEERING OF A PRODUCTION PROTOTYPE FLUORIDE VOLATILITY SYSTEM**
O. E. Heady *In its* Fluoride Volatility 1968 p 185 - 198 (See N69-37355 22-06)
Avail: CFSTI

The design of a production prototype fluoride volatility system is described. The prototype will be semicontinuous with a through-put of 12 kg of Pu/day. A high degree of remote control will allow the system to be operated from a control console. The processing of Pu by this method will greatly reduce the radiation exposure to the operating personnel. NSA

**N69-37381#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**FUELS AND MATERIALS DEVELOPMENT PROGRAM Quarterly Progress Report, Period Ending 30 Sep. 1968**
P. Patriarca (comp.), W. O. Harms (comp.), and D. J. Rucker (ed.) Feb. 1969 320 p refs
(Contract W-7405-ENG-26)
(ORNL-4350) Avail: CFSTI

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1. FUELS AND CLADDINGS p 1 - 83 refs (See N69-37382 22-22)
2. COOLANTS p 85 - 135 refs (See N69-37383 22-22)
3. RADIATION DAMAGE TO STRUCTURAL MATERIALS p 137 - 225 refs (See N69-37384 22-22)
4. TECHNIQUES OF FABRICATION AND TESTING p 227 - 289 refs (See N69-37385 22-17)
5. ENGINEERING PROPERTIES OF REACTOR MATERIALS p 291 - 310 refs (See N69-37386 22-22)

**N69-37382#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**FUELS AND CLADDINGS**
*In its* Fuels and Mater. Develop. Program Feb. 1969 p 1 - 83 refs (See N69-37381 22-22)
Avail: CFSTI

Development, characteristics of nuclear fuels, and irradiation tests of sol-gel fast reactor fuels are examined along with nitride fuel development. Equipment and procedures used to determine the amount of nonfission heating required for in-reactor thermal diffusivity measurements are described as are the effects of temperature, fission density, and burnup on thermal diffusivity and fission gas release of UN, sol-gel, and high density spheres and

pellets of $PuO_2$-$UO_2$ fuels. Fabrication and texture control of zirconium tubing are also discussed. J.A.M.

**N69-37383#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**COOLANTS**
*In its* Fuels and Mater. Develop. Program Feb. 1969 p 85-135 refs (See N69-37381 22-22)
Avail: CFSTI

Recent results from the program to investigate the chemical and metallurgical effects produced in reactor structural materials during exposure to alkali metals are reported. Refluxing capsules of W-base-26% Re were tested in K for 5000 hrs at a boiler-condenser temperature of 1250°C. A capsule fabricated by powder metallurgy methods showed no measurable corrosion effects but one from arc-melted material contained a crystalline deposit of almost pure W. A natural circulation K loop of TZM alloy was operated at 1200°C for 4400 hrs, until a creep failure occurred in the vapor line. The effects of oxygen on the compatibility of alkali metals and refractory metals for the TA-O-K system at 800 and 1000°C were evaluated. Penetration by K occurred in all but one specimen of the test series: preferentially along grain boundaries. It is believed that attack proceeded with formation of a ternary oxide which dissolved in K as the system approached equilibrium. Author (NSA)

**N69-37384#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**RADIATION DAMAGE TO STRUCTURAL MATERIALS**
*In its* Fuels and Mater. Develop. Program Feb. 1969 p 137-225 refs (See N69-37381 22-22)
Avail: CFSTI

The effects of high fast neutron influences at 150 to 1100°C on the properties of nonfissionable ceramic materials, the carbides, nitrides, and silicides of refractory metals were studied. Fast neutron effects on materials suitable for electrical insulators in thermionic converters and evaluation of neutron damage in these materials were discussed as well as mechanical properties and radiation effects of structural materials. J.A.M.

**N69-37386#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**ENGINEERING PROPERTIES OF REACTOR MATERIALS**
*In its* Fuels and Mater. Develop. Program Feb. 1969 p 291-310 refs (See N69-37381 22-22)
Avail: CFSTI

Basic metallurgy studies were performed including tests on solubility, diffusivity, permeability, and aging. Emphasis was placed on material problems involving tantalum, niobium, molybdenum, and vanadium base alloys for systems that use alkali metals as thermodynamic working fluids and heat transfer media. Superalloys in thermoelectric power devices were also investigated. J.A.M.

**N69-37401#** Oak Ridge National Lab., Tenn.
**MOLTEN-SALT REACTOR PROGRAM Semiannual Progress Report, Period Ending 31 Aug. 1968**
Feb. 1969 350 p refs
(Contract W-7405-ENG-26)
(ORNL-4344) Avail: CFSTI

CONTENTS:

1. MOLTEN-SALT REACTOR EXPERIMENT p 1-52 refs (See N69-37402 22-22)
2. MSBR DESIGN AND DEVELOPMENT p 53-108 refs (See N69-37403 22-22)
3. CHEMISTRY p 109-199 refs (See N69-37404 22-22)
4. MOLTEN-SALT IRRADIATION EXPERIMENTS p 200-210 refs (See N69-38405 22-22)
5. MATERIALS DEVELOPMENT p 211-290 refs (See N69-37406 22-22)
6. MOLTEN-SALT PROCESSING AND PREPARATION p 291-327 refs (See N69-37407 22-22)

**N69-37402#** Oak Ridge National Lab., Tenn.
**MOLTEN-SALT REACTOR EXPERIMENT**
*In its* Molten-Salt Reactor Program Feb. 1969 p 1-52 refs (See N69-37401 22-22)
Avail: CFSTI

Reported are results from experimental work conducted with U-235. The experiment was an attempt to substitute other fuels for U-233 fuel salt. Several isotopes were tested after deposition in the heat transfer system. The stability of U-233 was tested and showed very good results. Other tests for the reactor included power levels on frequency response, fluorination data, radiation monitoring, and the performance of fuel recovery for the molten salt reactor. Results indicate all systems show good results. E.H.W.

**N69-37403#** Oak Ridge National Lab., Tenn.
**MSBR DESIGN AND DEVELOPMENT**
*In its* Molten-Salt Reactor Program Feb. 1969 p 53-108 refs (See N69-37401 22-22)
Avail: CFSTI

Modifications were made in the design of the molten salt reactor. These include improvements in reactor and heat exchange equipment, flowsheets, and plant layouts. Also presented are discussions on the pumping design and characteristics for xenon isotopes and sodium fluoroborates. Design parameters for 1000 Mw (electrical) single fluid-vertical single pass counterflow, and a single fluid-fuel system are included. E.H.W.

**N69-37404#** Oak Ridge National Lab., Tenn.
**CHEMISTRY**
*In its* Molten-Salt Reactor Program Feb. 1969 p 109-199 refs (See N69-37401 22-22)
Avail: CFSTI

An evaluation is made, through analytical methods, for the working efficiency of the molten salt reactor. Information includes chemical and physical properties of molten salts, fission products, fuel processing technology, and other pertinent systems. Stability, high temperature, and radioisotope studies are included in the evaluation. E.H.W.

**N69-37405#** Oak Ridge National Lab., Tenn.
**MOLTEN-SALT IRRADIATION EXPERIMENTS**
*In its* Molten-Salt Reactor Program Feb. 1969 p 200-210 refs (See N69-37401 22-22)
Avail: CFSTI

An off-gas jumper line was developed to analyze fission product concentrations in molten salt reactors. Radiation tests are performed on reactor fuels for breeder and molten salt reactors. Gamma radiation effects are examined in sodium fluoborates and measurements of gamma radiation concentrations are included in the discussion. E.H.W.

**N69-37406#** Oak Ridge National Lab., Tenn.
**MATERIALS DEVELOPMENT**
*In its* Molten-Salt Reactor Program Feb. 1969 p 211-290 refs (See N69-37401 22-22)
Avail: CFSTI

Results are discussed for experiments with Hastelloy N and graphite. Irradiation damage in the materials are discussed and results indicate that both strength and ductility are affected in Hastelloy N material. Included in the surveillance are discussions on temperature problems, corrosion, aging, and welding of metal joints

used in the program. These studies were made for the molten salt reactor. E.H.W.

**N69-37407#** Oak Ridge National Lab., Tenn.
**MOLTEN-SALT PROCESSING AND PREPARATION**
*In its* Molten-Salt Reactor Program Feb. 1969 p 291–327 refs (See N69-37401 22-22)
Avail: CFSTI

Preparations were made for performance of several nondestructive tests of molten salts for nuclear reactors. Tests were conducted at high temperature in pressures of .1 MM mercury. Included are volatility measurements by transpiration, distribution measurements in molten salt–metal systems, simulated molten salt–liquid bismuth contractor studies, and distillation of fuel carrier salt. Chemical data obtained show great potential for improvements in the nuclear reactor systems. E.H.W.

**N69-37552#** Oak Ridge National Lab., Tenn.
**MOLTEN-SALT REACTOR PROCESSING**
*In its* Chem. Technol. Div. Sep. 1968 p 1–33 refs (See N69-37551 22-06)
Avail: CFSTI

Development work, facilities, plans for the fuel salt processing, and the program which led to the preparation of uranium 233 eutectic in the shielded molten salt facility are discussed. Described is a reductive extraction process for the removal of protactinium and other fission products from the reactor fuel salts that contain also thorium fluoride. Also included are feasibility data for reductive extractions and calculational analyses on proposed flow sheets with alternatives. G.G.

**N69-37553#** Oak Ridge National Lab., Tenn.
**DEVELOPMENT OF AQUEOUS PROCESSES FOR FAST REACTOR FUELS**
*In its* Chem. Technol. Div. Sep. 1968 p 34–55 refs (See N69-37551 22-06)
Avail: CFSTI

Solvent extraction processes for large quantities of fissile materials from fast reactors have to cope with: (1) higher plutonium contents; and (2)increased fission product activities in the feed. Clear definitions of the problems and a delineation of the areas of investigation show that fuel shipment equipment and techniques as well as the adequate dissipation of fission product decay heat by natural means are most important. The discharge of tritium to the environment has to be minimized and a process to isolate the tritium prior to its dilution with dissolver solution by oxidative treatment is outlined; this process also liberates iodine, xenon, and krypton fission products. G.G.

**N69-37554#** Oak Ridge National Lab., Tenn.
**DEVELOPMENT OF PROCESSES FOR HTGR AND LWR FUELS**
*In its* Chem. Technol. Div. Sep. 1968 p 56–67 refs (See N69-37551 22-06)
Avail: CFSTI

The engineering evaluation and development of the head-end portion of a processing flowsheet for the recovery of fissile and fertile particles from the graphite fuel block was continued by the investigation of: (1) hacksawing as a method for reducing the hexagon-shaped graphite fuel block to a size suitable for feed to a hammer mill or crusher; (2) the crushing characteristics of an unfueled section of the PSC graphite fuel block, using a hammer mill; (3) a jet penetration technique, using high-pressure water as a possible method for removing unirradiated pyrocarbon-coated $UO_2$ and $ThO_2$ particles from a prototype PSC fuel stick, and (4) fluidized-bed burning and sizing. A grind-leach process, using multiple leachings of coarsely crushed fuel kernels and pyrolytic carbon coatings of the particles, indicated a high retention of fission products by the leached carbon residue. Author

**N69-37555#** Oak Ridge National Lab., Tenn.
**FLUORIDE-VOLATILITY PROCESSING**
*In its* Chem. Technol. Div. Sep. 1968 p 68–71 refs (See N69-37551 22-06)
Avail: CFSTI

Design work for the fluoride volatility plant at Oak Ridge was terminated and equipment fabrication halted. Laboratory development work centered on the processing of irradiated uranium oxide pellets in hot cells and the sorption of fission products on sodium fluoride. It was shown that the removal of niobium fluorides was a function of temperature, with a maximum of about 450°C, and a second-order function of niobium fluride concentration in the gas stream. Experiments on the development of a recovering process for neptunium showed promise. G.G.

**N69-37556#** Oak Ridge National Lab., Tenn.
**WASTE TREATMENT AND DISPOSAL**
*In its* Chem. Technol. Div. Sep. 1968 p 72–91 refs (See N69-37551 22-06)
Avail: CFSTI

Economical and operational problems in the processing and disposal of wastes from high temperature gas-cooled reactors, molten salt reactors, and other types of fast reactors were studied. Evaluated were: (1) conversion into solids of high level radioactive wastes which contain nearly all the fission products; (2) incorporation into asphalt or polyethylene of intermediate-level wastes with high salt content; and (3) removal of radionuclides from low-level radioactive wastes with decontaminated water discharge to the environment or recycling for use; in the latter case, the recovered solids can be shipped to a final deposit site. GG.

**N69-37557#** Oak Ridge National Lab., Tenn.
**TRANSURANIUM ELEMENT PROCESSING**
*In its* Chem. Technol. Div. Sep. 1968 p 92–128 refs (See N69-37551 22-06)
Avail: CFSTI

Dissolution of targets, preparation of feeds, recovery of plutonium, and decontamination of obtained transplutonium elements from fission products were demonstrated at the high flux isotope reactor facility. Irradiated targets were processed by anion exchange methods in high pressure columns and products were separated into an americium-curium fraction, a berkelium fraction, and a transberkelium fraction for further treatment. Processed irradiated targets yielded multigram amounts of americium 243 and curium 244. Startup of the remote fabrication line was accomplished and six curium recycle targets and three special californium targets were fabricated. G.G.

**N69-37567#** Oak Ridge National Lab., Tenn.
**REACTOR EVALUATION STUDIES**
*In its* Chem. Technol. Div. Sep. 1968 p 225–237 refs (See N69-37551 22-06)
Avail: CFSTI

Continuing studies of various advanced reactor and fuel-cycle systems to determine engineering and economic feasibility are reported. Included are cost studies of shipping fresh and spent nuclear fuel; reprocessing spent fuel; and preparing various virgin and recycle fuel materials (oxides, metals, fluorides, etc.), primarily in support of the evaluation of civilian nuclear power for the period 1970-2020. Computer codes were developed to calculate rational growth patterns for the fuel cycle industry and to make projections of cost versus time for the various steps in the fuel cycle, based on both marketplace (nonoptimal) and optimal economic models. A computer code, was written to calculate individual fission product isotopes, fission product elements, groups of chemically similar elements, and their gross totals, as well as beta and gamma decay

heat release rates. The program also calculates gamma photon release rates in terms of 18 energy groups for use in shielding calculations. Author

N69-37570# Oak Ridge National Lab., Tenn.
**SAFETY STUDIES OF FUEL TRANSPORT**
*In its* Chem. Technol. Div. Sep. 1968 p 249-255 refs (See N69-37551 22-06)
Avail: CFSTI

Criteria to provide a series of cask design standards and specifications which, if followed, should insure adherence to requirements set forth in Atomic Energy Commission regulations are under development. Suitable engineering standards are to be established for the design, fabrication, and inspection of irradiated-fuel shipping casks; these will provide information on structural integrity, shielding, heat transfer, criticality, materials of construction, and fabrication techniques. Specification and standards presented are to be based on data from experiments and analyses. Approximately 85% of the criteria have been documented. A.C.R.

N69-37592# Aktiebolaget Atomenergi, Stockholm (Sweden).
**CONTROL ROD REACTIVITY MEASUREMENTS IN THE AGESTA REACTOR WITH THE PULSED NEUTRON METHOD**
Kjell Bjoreus 1969 46 p refs
(AE-364) Avail: CFSTI

An extensive series of control rod measurements was made in the Agesta reactor during the low power experimental period following the first criticality. This report describes the part of these investigations made with the pulsed neutron method, comprising nearly 300 measurements. The main objective was the determination of control rod reactivity worths for different rods and groups of rods, but some supplementary measurements were also made, e.g. a determination of the prompt neutron decay constant for the delayed critical condition and four different cores. The cores consisted of 20, 32, 68, and 140 fuel elements respectively, and measurements were made at room temperature and with the moderator level close to critical for each core, and for the 140-element core also with full moderator height and at the temperatures 140°C and 215°C. Both fully and partly inserted control rod groups were investigated. The measurements at critical water level give directly the control rod reactivity worths, whereas those with full water height give the shut-down reactivity. A comparison was made between measured reactivity worths for a number of rod groups and those calculated with the Hetaro code. The prompt neutron decay constant at delayed criticality $\alpha_0 = \beta/l$, for the full core at 215°C was found to be 9.60 ± 0.30 $sec^{-1}$, corresponding to $l = 0.76 \pm 0.02$ msec. The shut-down reactivity with 18 coarse control rods in pos. A-D 22, 40-04, 44, 26 is −5% at 25°C and −13% at 215°C. The relative error is usually around 8% in the reactivity worths, originating mainly from the higher harmonics content in the measured curves. Author (ESRO)

N69-37787# Atomic Energy Commission Research Establishment, Risö (Denmark). Reactor Physics Dept.
**SCANDINAVIAN REACTOR PHYSICS CO-OPERATION ON POINT AND CELL BURN-UP CODES. BURN-UP CALCULATIONS FOR HEAVY WATER REACTORS**
B. Michaelsen 7 May 1969 39 p refs
(RISO-M-897) Avail: CFSTI

The results of a number of point and cell burn-up programs used in Scandinavia have been compared. The comparison was made for three types of heavy water reactor. Author (ESRO)

N69-37885# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
**AEC FUELS AND MATERIALS DEVELOPMENT PROGRAM**
31 Dec. 1968 314 p refs
(Contract AT(40-1)-2847)
(GEMP-1010) Avail: CFSTI

Reported are physico-chemical studies on fuel element cladding materials and their fatigue properties, as well as material developments for fast breeder reactor control, shieldings, and reflectors. Thermocouple development for fast breeder reactors was 90% completed, and the advanced pressure vessel materials development progressed with the evaluation of maraging steels. G.G.

N69-37892# Atomic Energy Commission Research Establishment, Risö (Denmark). Reactor Physics Dept.
**PREDICTION OF BURNOUT IN THE MARVIKEN OUT-OF-PILE FUEL TEST ELEMENTS, USING THE HAMBO PROGRAMME AND THE BECKER BURNOUT CORRELATION**
F. W. Cortzen, A. Olsen, and H. Abel-Larsen 28 May 1969 28 p refs Presented at the Conf. of the European Two-Phase Flow Group, Karlsruhe, Ger., 2-5 Jun. 1969
(RISO-M-900) Avail: CFSTI

The use of the thermohydraulic subchannel program, programme, HAMBO, and the Becker burnout correlation (with cold-wall effect) on the rather open, Marviken heavy water fuel test elements, FT36a and FT36b, predicts the burnout heat flux, within ± 10% and predicts the local burnout situ, in an excellent manner. The calculation presupposes a calculation of the local void distribution with a fitting of the void calculation and the mixing scaling factor. The Becker burnout correlation in the calculational environment of HAMBO, shows a systematic massflow-dependent deviation of the predicted burnout heat flux from the experimental burnout heat flux. Author (ESRO)

N69-37895# Institute of Nuclear Research, Warsaw (Poland).
**INFLUENCE OF LEAKAGE CONDUCTANCE ON IONIZATION SMOKE DETECTORS [WPLYW UPLYWNOSCI NA PRACE IZOTOPOWYCH CZUJEK DYMU]**
Bronislaw Machaj 1968 12 p ref In POLISH; ENGLISH summary
(INR-974) Avail: AEC Depository Libraries

Relations determining correlation of parameters of ionization smoke detectors have been derived and with their help the influence of leakage conductance discussed. Author (NSA)

N69-37897# Mound Lab., Miamisburg, Ohio.
**ELECTRODEPOSITION OF PLUTONIUM FOR ALPHA PULSE HEIGHT ANALYSIS OF Pu 236 IN Pu 238**
W. R. Amos and R. H. Lambek 9 May 1969 7 p refs
(Contract AT(33-1)-GEN-53)
(MUM-1621) Avail: CFSTI

An apparatus was constructed and a method was developed for the electrodeposition of nanogram quantities of plutonium onto a stainless steel slide. The deposit was thin, uniform, and alpha-wipe free, and the plutonium was quantitatively transferred from the plating solution. Because of the characteristics of the deposit, accurate alpha pulse height analysis of small quantities of Pu 236 in Pu 238 was possible. Author (NSA)

N69-37905# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**X-RAY ATTENUATION SCANNING OF NUCLEAR FUEL PLATES**
B. E. Foster, S. D. Snyder, and R. W. Knight Jun. 1969 18 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2525) Avail: CFSTI

A sophisticated technique has been developed and successfully used for high-speed homogeneity evaluation of reactor fuel plates. Specially designed X-ray equipment is used as the irradiation source, while a NaI(Tl) crystal optically coupled to a photomultiplier tube serves as the radiation detector. Careful control of the operating

conditions produces very accurate and reproducible results. The method uses the X-ray attenuation principle, and on recent applications the area of evaluation has been as small as 0.0048 in.$^2$. Precise mechanical x-y scanning of the fuel plate is accomplished with longitudinal speeds of 0 to 250 in./min and horizontal indices of 0 to 5 in. in 0.001 in. increments. The system is provided with recording capabilities for continuous quantitative data or automatic readout for a go no-go operation. Tolerance limits are set by a series of programmed equivalent attenuation standards at the beginning of each longitudinal pass of the fuel plate through the X-ray beam.
Author (NSA)

**N69-37918#** Battelle Memorial Inst., Columbus, Ohio.
**DEVELOPMENTS IN THE TECHNOLOGY OF NUCLEAR FUELS DURING AUGUST - OCTOBER 1968**
Donald L. Keller and Watson Chubb 1 Nov. 1968 90 p refs
(Contract W-7405-ENG-92)
(BMI-1854) Avail: CFSTI

Four samples of bulk $UO_2$ exhibited columnar grain growth and signs of lenticular void formation at temperatures near 1500°C. Saturation of swelling was observed at volume increases ranging from 6 to 20 percent at burnups below $1 \times 10^{20}$ fissions per cm$^3$. Surface temperatures decreased from 1750 to 1440°C as the irradiation progressed. Since swelling remained saturated after a burnup of $1 \times 10^{20}$ fissions per cm$^3$ and since mainly large voids and columnar grains appear in the postirradiation microstructures, it must be presumed that the processes of grain growth and gas release remained active as surface temperatures decreased to 1440°C. Two of the above samples of $UO_2$ were vented to internal plenums by 0.110-in. axial holes; the other two were vented to internal plenums by tantalum tubes extending to their geometric centers. The latter swelled 6 to 12 vol %, whereas the former swelled 15 to 20 vol %. Examination has indicated that the tantalum tubes acted to change the thermal profile so as to produce an annular void rather than a central void in these samples.
Author (NSA)

**N69-38007#** Commissariat à l'Energie Atomique, Marcoule (France). Centre de Production de Plutonium.
**DECONTAMINATION OF IRRADIATED-FUEL PROCESSING WASTES USING MANGANESE DIOXIDE HYDRATE [DECONTAMINATION DES EFFLUENTS DE TRAITEMENT DES COMBUSTIBLES IRRADIES PAR LE BIOXYDE DE MANGANESE HYDRATE]**
Jacqueline-Marguerite Auchapt and Jean-Francois Gaudier Jun. 1969 39 p refs In FRENCH; ENGLISH summary
(CEA-R-3821) Avail: CFSTI

The manganese dioxide process is designed to replace the calcium carbonate treatment of low and medium activity wastes. The objective of this search for a new process was the diminution of the volume of the sludge without decreasing the decontamination factor of the wastes. The new process involves the addition of two series of 100 ppm of $Mn^{2+}$ to the waste which has previously been made basic and oxidizing; the precipitate formed in situ is separated after each addition. The process also has the advantage of increasing the decontamination of strontium. The treatment can be used in a plant with two decantation units and has given effective results.
Author (ESRO)

**N69-38022#** Commissariat à l'Energie Atomique, Marcoule (France). Centre de Production de Plutonium.
**THE USEFULNESS OF THE DECAY RATE IN THE MANAGEMENT OF RADIOACTIVE WASTE STOCKS [DE L'INTERET DE LA DECROISSANCE POUR LA GESTION DES DECHETS RADIOACTIFS]**
Jean Rodier and Gérard Cohendy May 1969 24 p refs In FRENCH; ENGLISH summary
(CEA-R-3731) Avail: CFSTI

It became apparent, during the first few years operation of the Marcoule Center, that it was very useful to exploit the natural decay rate of the radioactive element contaminating the waste. The storage of this waste under the best possible conditions in each case, was first of all favorable for the radiological safety point of view; it led, furthermore, to a marked reduction in the cost since it made it possible to avoid using protection means which would have proved to be excessively outsize after a few years. Finally, even when the half-life of the radioelements involved seemed to annul any possible advantages of this method, the temporary storage made it possible to develop treatment processes which were unknown at the time. The overall result of this policy is that at the present time over 98 per cent of the solid waste produced by the Marcoule Center has been processed in such a way that it can, at any moment, be discharged from the site without difficulty.
Author (ESRO)

**N69-38035#** Atomic Energy Establishment, Winfrith (England). Fast Reactor Physics Div.
**PROGRESS IN THE APPLICATION OF SOLID-STATE TRACK RECORDERS TO REACTOR PHYSICS EXPERIMENTS**
C. B. Besant and S. S. Ipson Mar. 1969 38 p refs
(AEEW-M-881) Avail: CFSTI; HMSO: 6s

Strain energy fields produced by heavily ionizing particles passing through insulating materials may be observed directly with an electron microscope or, after etching, the tracks may be seen with an optical microscope. This technique was applied to detecting fission fragments from fissions taking place in a thin source of fissile material. The source, together with the insulating material, is termed a solid-state track recorder and was applied to the measurement of fission ratios in the fast critical assembly ZEBRA at Winfrith. The main disadvantage of the technique has been in counting tracks by eye, which is laborious and subject to the human element. This has been overcome by counting tracks with a Quantimet-Computer Image Analyzer. Absolute fission rate measurements are also discussed, and it has been found that measurements to an accuracy of better than ±1% should be possible with this technique.
Author (NSA)

**N69-38042#** Harvard Air Cleaning Lab., Cambridge, Mass.
**PROCEEDINGS OF THE TENTH AEC AIR CLEANING CONFERENCE**
Melvin W. First, ed. and James M. Morgan, Jr., ed. Dec. 1968 370 p refs Conf. held New York, 28 Aug. 1968; Sponsored by Harvard Air Cleaning Lab. and AEC
(CONF-680821) Avail: CFSTI

Conference papers pertain to air cleaning systems and system components, adsorbents for iodine removal, and the efficiency of air cleaning systems under both normal and accident conditions. For individual titles, see N69-38043 through N69-38064.

**N69-38043#** Harvard Air Cleaning Lab., Cambridge, Mass.
**AIR CLEANING SYSTEMS: REVIEW AND PROJECTION**
F. J. Vites, Jr. *In its* Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 13-28 refs (See N69-38042 22-22)
(Contract AT(30-1)-841)
Avail: CFSTI

Filter-charcoal air cleaning systems and their application, testing, and suggested further development are described for cleanup of containment atmospheres following fission product release from reactor water coolant failures. Decontamination of containment air by condensation processes, sprays, gas phase reactions, foams, and diffusion boards are discussed briefly and their use noted as supportive operations to affect more rapid cleanup. Comparisons of air cleaning problems and design are made between water and sodium cooled reactors accidents.
Author

**N69-38044#** Battelle-Northwest, Richland, Wash.
**FACILITIES AND PROCEDURES FOR TESTING LARGE**

**SCALE AIR CLEANING SYSTEMS. CONTAINMENT SYSTEMS EXPERIMENT**

C. E. Linderoth and J. D. Mc Cormack *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 27–54 (See N69-38042 22-22)
(Contract AT(45-1)-1830)
Avail: CFSTI

The primary facilities of the containment systems experiment are described in brief and pertinent physical data provided. The equipment designed for the internal air cleaning system is described in some detail. A series of six experiments is discussed which has the objective of determining the effect of a recirculating filter system on the behavior of fission products in containment under post accident conditions. Author

**N69-38045#** Dupont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.

**MOISTURE SEPARATORS**

A. H. Peters *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 56–64 refs (See N69-38042 22-22)
Avail: CFSTI

The function, features, and testing recommendations for moisture separators in reactor containment applications are summarized. Author

**N69-38048#** Herty Foundation, Savannah, Ga.

**REDEVELOPMENT OF THE SAVANNAH RIVER LABORATORY MOISTURE RESISTANCE TEST FOR FILTER PAPER**

H. C. Schwalbe *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 88–108 refs (See N69-38042 22-22)
Avail: CFSTI

Users of HEPA filter media for reactor containment specify exposure of filter media for 10 days to a steam-air mixture to guaranty freedom from breaks in the media in actual filter installations. This test was found to be superior to the water repellency test. A redeveloped test of two hours duration in a modified apparatus is described. A method to assess changes in elasticity was introduced. Two transducers of the sonic modulus tester are mounted on the inside of the exposure chamber and contact the filter media. Author

**N69-38053#** Idaho Nuclear Corp., Idaho Falls.

**A HIGHLY EFFICIENT INORGANIC ADSORBER FOR AIRBORNE IODINE SPECIES (SILVER ZEOLITE DEVELOPMENT STUDIES)**

W. J. Maeck, D. T. Pence, and J. H. Keller *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 185–203 (See N69-38042 22-22)
Avail: CFSTI

A synthetic zeolite, Linde Molecular Sieve 13X, converted to the silver form strongly adsorbs inorganic and organic species of airborne iodine. As a filter material for the cleanup of iodine from reactor containment atmospheres, it has ideal properties of nonflammability, high temperature operability with adsorption of iodine up to 500°C, retention of iodine up to 1000°C, and a rapid reaction time. Retentions of greater than 99.98% have been measured for elemental iodine and for methyl iodide for a variety of conditions varying from dry flows at room temperature, dry flows at 500°C, and steam-air mixtures. Other applications of this material include: cleanup of dissolver off-gas from chemical processing plant operations, filter materials for health physics safety devices such as face masks and air monitors, and adsorbing filters in sampling devices. Author

**N69-38066#** Oak Ridge National Lab., Tenn. Reactor Chemistry Div.

**DEVELOPMENT OF A SAMPLING DEVICE FOR DISTINGUISHING THE FORMS OF IODINE IN A HUMID ATMOSPHERE**

R. L. Bennett and R. E. Adams *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 235–262 refs (See N69-38042 22-22)
Avail: CFSTI

Analytical samplers, capable of distinguishing and measuring particulate, elemental, and the less radiative iodine forms such as methyl iodide, are needed to aid in the assessment of the hazard of an accidental iodine release from a nuclear reactor and to predict its subsequent behavior. A major problem in the application of May pack iodine samplers has been the difficulty in finding the proper sequence of materials that will reproducibly separate the particulate iodine from elemental iodine. An improved sampler has been devised which contains a silver-plated aluminum inlet section that serves as a diffusion battery. The reactive molecular iodine is separated from aerosol particles due to its greater diffusivity. Test data to support this iodine sampling concept are presented. Author

**N69-38067#** Oak Ridge National Lab., Tenn. Reactor Chemistry Div.

**RADIOACTIVE AEROSOL SIZE CLASSIFICATION EXPERIENCE WITH A LOW PRESSURE CASCADE IMPACTOR**

G. W. Parker, H. Buchholz, and W. J. Martin *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air cleaning Conf. Dec. 1968 p 263–311 refs (See N69-38042 22-22)
Avail: CFSTI

An improvement on a standard instrument, an inertial impactor, which operates at subatmospheric pressure thereby increasing both the mean free path of the air molecules and the Cunningham correction, was conceived and investigated. A commercially available impactor was first successfully modified for low pressure operation to extend its range to submicron sizes and then an impactor of original design was built, tested, and calibrated. The useful range of the instrument was found to be from less than 0.01 micron to several microns particle diameter. The range is variable and is dependent upon the selected operating pressure. In-fuel meltdown experiments, aerosol particle sizes, chemical identification, and associated radioactivity were determined and size comparisons were made by electron microscopy. The ease of particle measurement by this device has contributed an extra benefit in terms both of the characterization of chemical forms of airborne radioactivity as well as to a simple model of aerosol formation and agglomeration. Author

**N69-38058#** Rocky Flats Div., Dow Chemical Co., Golden, Colo.

**OFF-GAS SYSTEMS FOR NUCLEAR CONTAMINATED COMBUSTIBLES**

R. D. Geskins and W. G. Kazel *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 312–329 refs (See N69-38042 22-22)
Avail: CFSTI

Incinerator off-gas systems are described and a discussion of wet and dry off-gas equipment and subsequent problems is given. Author

**N69-38059#** Atomics International, Canoga Park, Calif.

**THE USE OF AGGLOMERATION MODELING IN DETERMINING THE SOURCE TERM FOR REACTOR SITING EVALUATIONS**

R. L. Koontz, D. F. Haushnecht, and H. A. Morewitz *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 330–334 (See N69-38042 22-22)
Avail: CFSTI

An equation has been obtained which shows that the fraction of the released mass which leaks from a reactor enclosure varies (at a constant leak rate and height of building) inversely as the square of the mass median particle radius. Additionally, if the mass

median radius is proportional to the released mass concentration the leaked fraction decreases as the mass concentration increases. Author

**N69-38064#** Army Nuclear Defense Lab., Edgewood Arsenal, Md.

**PREFABRICATED EMERGENCY INCINERATOR FOR RADIOACTIVE WASTES**

Ernest W. Bloore *In* Harvard Air Cleaning Lab. Proc. of the 10th AEC Air Cleaning Conf. Dec. 1968 p 362-387 (See N69-38042 22-22)

Avail: CFSTI

The objectives were to evaluate the feasibility of using a prefabricated incinerator to concentrate contaminated combustible materials from an emergency situation and to evaluate the airborne radiological hazard resulting from the combustion process. The incinerator is a prototype used for emergency situations only, not for routine incineration. The unit combines many of the concepts that have proved to be effective in more complex incinerator systems. Among these are overfire-combustion-air for improved gas stream turbulence, a secondary combustion zone to minimize discharge of unburned materials, and tangential firing of burners to induce a rotating gas stream. This stream results in increased retention time for particulate in the combustion zones. Author

**N69-38079#** Oak Ridge National Lab., Tenn. General Engineering Div.

**SURVEY OF BERYLLIUM TECHNOLOGY AND NUCLEAR APPLICATIONS**

Hui Pih Jun. 1968 72 p refs

(Contract W-7405-ENG-26)

(ORNL-4421) Avail: CFSTI

A compilation of information is presented that is directed toward certain areas of the use of beryllium in nuclear applications that may be of particular interest to the designer of nuclear reactors. These areas include the effects of neutron irradiation by beryllium, the design considerations in the use of beryllium, and beryllium fabrication methods. Author (NSA)

**N69-38098#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

**THEORETICAL, PHYSICAL, AND EXPERIMENTAL STUDY OF FISSILE AQUEOUS MEDIA [ETUDES THEORIQUE, PHYSIQUE ET EXPERIMENTALE DES MILIEUX FISSILES AQUEUX]**

Robert Cauvegues (Ph.D. Thesis--Paris Univ.) Apr. 1969 187 p refs In FRENCH; ENGLISH summary

(CEA-R-3850) Avail: CFSTI

This report is composed of the following theoretical and experimental studies: a) theoretical calculation methods used for cross-sections and critical parameters; b) comparison of theoretical and experimental results; (it is shown that the agreement between these results cannot be improved above a certain limit because of the accuracy with which the composition and dimensions of the media and the microscopic cross-sections are known); c) determination of the ratios 9/5, 3/5 for fissile aqueous media (ν: number of neutrons emitted per neutron absorbed, averaged over the reactor neutron spectrum) and evaluation of their accuracy; d) effect of Pu-240, the measurement being carried out on Pu with a Pu-240 content of 1.5 per cent, 3.11 per cent and 9.95 per cent; calculation of the resonance integral $I_{240}$ using the experimental results gave values in reasonable agreement with the results obtained by other more conventional methods; e) measurement of the spectrum indices for aqueous media containing Pu, $U_5$ and $U_3$. With these latter it was possible to obtain mean fission cross-section ratios f 239 / f235 for these different spectra. Author (ESRO)

**N69-38152#** Atomic Weapons Research Establishment, Aldermaston (England).

**THE DETERMINATION OF NATURAL RADIOACTIVE IMPURITIES IN THE RAW MATERIALS OF Li 6 LOADED CERIUM SCINTILLATION GLASSES AND THEIR REMOVAL**

L. P. O'Conner Apr. 1969 14 p refs

(AWRE-O-15/69) Avail: CFSTI; HMSO: 2s 6d

Raw materials for the production of neutron-detecting lithium-loaded cerium scintillation glasses were found to contain naturally occurring radioactive nuclides at levels which invalidated the use of the glasses in low-geometry detecting systems. The estimation of the radioactive species in the materials is described, and an account is given of the purification procedures used and the decontamination achieved by them. Author (NSA)

**N69-38153#** Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.

**MAINS-OPERATED CADMIUM SULPHIDE DETECTOR HIGH-LEVEL GAMMA EXPOSURE RATEMETER**

W. H. R. Hudd and W. N. Walker Apr. 1969 9 p ref

(RD/B/N-1336) Avail: AEC Depository Libraries

A mains operated cadmium sulfide crystal detector high level gamma exposure-rate meter covering the range 1 R/hr to 50 KR/hr is described. A radiation level at which a trip is required to operate may be pre-set. When this level is reached indication is provided on the instrument and a mains output is available to drive external equipment. Author (NSA)

**N69-38154#** Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.

**MODIFICATION OF THE BNL 250-KV X-RAY SET AND THE RECALIBRATION OF ITS OUTPUT**

A. Lavender, I. M. G. Thompson, R. G. Shipton, and J. Goodwin May 1969 20 p refs

(RD/B/N-1263) Avail: AEC Depository Libraries

The 250 kV X-ray set operated at Berkeley Nuclear Labs. for health physics instrument calibration and assessment was modified and its output recalibrated. Measurements of the spectra led to a modification of two of the filter combinations used. A description of a voltmeter installed to measure the tube potential is given. The addition of the voltmeter circuit leads to stable tube operation at lower currents than previously obtainable. The use of the voltmeter also enables the beam conditions to be adequately defined over a wider range of working exposure rates. A comparison was made between the National X-ray Standard and the secondary instrument used in the CEGB facility. Author (NSA)

**N69-38182*#** College of William and Mary, Williamsburg, Va. Dept. of Physics.

**VERSATILE LIQUID HELIUM SCINTILLATION COUNTER OF LARGE VOLUME DESIGN**

D. C. Buckle, J. R. Kane, B. D. Orrick, R. T. Siegel, and R. J. Wetmore [1968] 19 p refs

(Grant NGL-47-006-008)

(NASA-CR-106008; W/M-18) Avail: CFSTI CSCL 18D

A 3 liter liquid helium counter has been assembled and used in two experimental configurations. The operation of the scintillation chamber is described in terms of these experiments, and the pulse height and resolution characteristics of the counter are given for the case where two 5 in. diam phototubes view the liquid helium with good geometry. Author

**N69-38190#** United Kingdom Atomic Energy Authority, Harwell (England).

**ON THE OPTICAL ANISOTROPY OF THE SAFETY GLASS IN THE 5-METRE HYDROGEN BUBBLE CHAMBER**

A. Zapletal Jan. 1969 31 p refs Transl. into ENGLISH from

Russian Report No. JINR-P13-4059
(NP-tr-1785) Avail: CFSTI

The stress condition of some safety glasses is determined. These glasses partition the photographic devices from the hydrogen, which is under pressure, in a hydrogen bubble chamber. This stress condition, from the pressure of the hydrogen and the seal, causes distortion of the image of the particle trajectories being photographed. To determine the extent of the distortion the stress condition of the glasses is studied. NSA

N69-38192# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**USE OF DIFFUSION BARRIERS IN REDUCING METAL-METAL INTERACTIONS AT 1100 DEG C**
H. T. Fullam May 1969 17 p refs
(Contract AT(45-1)-1830)
(BNWL-1015) Avail: CFSTI

In fabricating an isotope heat source, design considerations frequently dictate the use of multiple layer of dissimilar metals to contain the fuel. At high temperatures, interdiffusion between the dissimilar metals can endanger the integrity of the source. The use of diffusion barriers is one way of reducing or eliminating the interdiffusion reactions. Aluminum oxide films represent a logical choice for a diffusion barrier. Boron silicide was also suggested as a potential barrier material. In this study both materials were evaluated as diffusion barriers at 1100°C with a variety of metal-metal couples. Aluminum oxide appeared to effectively reduce metal-metal interaction as compared with couples in which no diffusion barrier was present. Boron silicide, on the other hand, apparently was ineffective in reducing the interaction. In some cases it appeared to increase interaction. Based on the results obtained with $Al_2O_3$, a more detailed study on its use as a diffusion barrier, appears warranted. Author (NSA)

N69-38251# California Univ., Livermore. Lawrence Radiation Lab.
**PULSE PROPERTIES OF LARGE 50–50 Ni-Fe TAPE CORES**
S. D. Winter, R. W. Kuenning, and G. G. Berg 5 May 1969 16 p refs Presented at IEEE Workshop on Appl. Magnetics, Washington, D.C., 22–23 May 1969 Sponsored by AEC
(UCRL-71514) Avail: CFSTI

Over 400 cores of 1-mil 50–50 NiFe, each core containing forty or more pounds of material, are used in a linear induction accelerator, which is a part of a controlled thermonuclear research experiment. Each core couples a constant voltage pulse of approximately 9 kV lasting 350 nsec to an electron beam whose current is in the hundreds-of-amperes range. To achieve reasonable operation of the accelerator it is essential that the drive power to the cores, both during the forward pulse and during reset, be kept to a minimum. Since cores of this size and constant voltage driver of this magnitude are both rarities, potential manufacturers of these cores have been reluctant to guarantee the pulse performance. To overcome this reluctance a study program consisting of both a theoretical analysis and experimental tests was conducted. Author (NSA)

N69-38255# Argonne National Lab., Ill.
**DESIGN AND APPLICATION OF CORROSION-RESISTANT HEATED TRANSFER TUBES FOR LIQUID METALS AND SALTS**
D. E. Grosvenor, I. O. Winsch, W. E. Miller, G. J. Bernstein, and R. D. Pierce Dec. 1968 19 p refs
(Contract W-31-109-ENG-38)
(ANL-7522) Avail: CFSTI

Pyrochemical processes under development at Argonne National Laboratory use liquid metals and molten halide salts as solvents to separate molten fuel materials from each other and from fission products. These solvents are moved between process vessels by pressure-transferring through resistance-heated transfer tubes operating at temperatures up to 850°C. The transfer tubes are J- or U-shaped and are fabricated from gun-drilled molybdenum-30 w/o tungsten bar stock. The tubes are shaped by hot-bending in a jig. A technique for joining two pieces of tubing was developed because of the limited overall length of tubing available. The transfer tubes are wrapped with resistance heaters, covered with insulation, and protected by steel shells. Temperatures are controlled by adjusting the voltages in the various heater circuits. Author (NSA)

N69-38281# Mound Lab., Miamisburg, Ohio.
**APOLLO LUNAR RADIOISOTOPIC HEATER SUMMARY REPORT**
D. P. Kelly and V. L. Avona 30 Apr. 1969 20 p
(Contract AT(33-1)-GEN-53)
(MLM-1637) Avail: CFSTI

Three Apollo Lunar Radioisotopic Heaters were designed and fabricated for environmental protection of seismic instrumentation on the moon. The heater will be part of the Early Apollo Scientific Experiments Package for the first lunar landing. Each heater was fueled with 37.6 g of plutonium-238 dioxide microspheres to produce 15 thermal watts. The fuel was encapsulated in multiple containers of Ta-10 wt % W alloy, Pt-10 wt % Rh alloy, titanium, graphite, and stainless steel to ensure safety. The safety of the design was confirmed by a series of tests which simulated all possible accidental conditions surrounding the Saturn V launch and flight. The three sources were shipped to Kennedy Space Center. Author (NSA)

N69-38287# Oak Ridge National Lab., Tenn.
**POSTIRRADIATION NONDESTRUCTIVE EXAMINATION OF A SILVER-CADMIUM-INDIUM CONTROL ROD FROM THE ARMY SM-1 POWER REACTOR**
A. E. Richt and V. O. Haynes Jun. 1969 21 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2508) Avail: CFSTI

An experimental silver-cadmium-indium neutron absorber element has been examined nondestructively after 10.4 Mwyr of service in the Army SM-1 Stationary Medium Power Reactor. The purpose of this examination was to determine if the element was dimensionally and structurally suitable for continued testing in the reactor; ultimately, it is hoped to establish the useful lifetime of this type of absorber element in the SM-1. The element was apparently in excellent physical condition. No evidence of structural damage was noted visually, gamma scans showed no indications of abnormalities in the absorber burnup distribution, and the outer dimensions of the element were well within acceptable limits. The sides of the absorber box were slightly thicker than the nominal 0.156-in. value; however, this appears to be typical of the absorber fabrication procedures and not a result of irradiation-induced swelling. Author (NSA)

N69-38291# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
**NUMERICAL EVALUATION OF SPATIALLY-DEPENDENT DYNAMIC REACTOR SYSTEMS USING PSEUDORANDOM SIGNALS**
R. A. Rydin and R. J. Hooper Jun. 1969 44 p refs Presented at the 15th Meeting of the Am. Nucl. Soc., Seattle, 15–18 Jun. 1969
(Contract W-31-109-Eng-52)
(KAPL-P-3812; CONF-690609-15) Avail: CFSTI

The cross correlation method of determining the impulse response of a dynamic system, which has been widely used in experiments, is applied numerically to a complicated mathematical model of a spatially dependent reactor system, and is concluded to be a practical alternative to analog computer analysis. The method is applied using two families of periodic discrete level signals as the input perturbation. It is demonstrated that a relatively new class of signals, having three possible levels, which has had

a very limited use to date, leads to a more accurate determination of the impulse response in the presence of strong system nonlinearities than do the better known and more widely used binary signals. Author (NSA)

**N69-38293#** Los Alamos Scientific Lab., N. Mex.
**ROVER FUEL ELEMENT THERMAL STRESS EXPERIMENTS AND ANALYSES**
John C. Rowley, Robert G. Lawton, and William R. Prince [1968] 13 p Sponsored by AEC
(LA-DC-10116; CONF-690601-1) Avail: CFSTI

The power-density and thermal-stress limitations of Rover reactor fuel elements are analyzed. Measurements are made on graphite elements loaded with pyrocarbon-coated $UC_2$ beads (bead-loaded). Thermal-stress experiments and analyses are also presented for graphite fuel elements having increased thermal expansion and for metal carbide–carbon composite fuel elements. Author (NSA)

**N69-38304#** General Electric Co., San Jose, Calif. Nuclear Fuels Dept.
**ZIRCALOY-CLAD URANIUM OXIDE FUEL ROD EVALUATION PROGRAM Quarterly Progress Report, Nov. 1968 - Jan. 1969**
F. H. Megerth, comp. Feb. 1969 21 p refs
(Contract AT(04-3)-189)
(GEAP-5746; QPR-5) Avail: CFSTI

The gas contents of seven cladding samples from five irradiated fuel rods were determined by vacuum hot extraction followed by chromatographic analysis with the molecular sieve column. Approximately 1 percent nitrogen was detected in three samples, and traces of methane were detected in six samples. The $UO_2$ of a transverse section through one of the fuel rods was examined by replica electron microscopy. The average burnup over the cross section was $8.1 \times 10^{20}$ fissions/cc (29,700 MWd/tU). There was no evidence of central grain growth. The interior of the grains in the central region of the fuel contained many small precipitates. The grain boundaries near the periphery of the $UO_2$ were more heavily etched than the centrally located grain boundaries; the severity of etching effect varied with fuel radius in a manner which can be correlated to the radial distribution of burnup. The radial dependence of burnup, uranium and plutonium isotopic contents, and the abundances of $^{241}Am$, $^{242}Am$, $^{244}Cm$, $^{148}Nd$, $^{137}Cs$, $^{106}Ru$, $^{134}Cs$, and $^{144}Ce$ was determined from analyses of fuel samples taken at different radial locations from the maximum burnup location of a high exposure fuel rod. Author (NSA)

**N69-38311#** California Univ., Berkeley.
**NEUTRON SPECTRUM MEASUREMENTS Progress Report, Dec. 1968**
Harvey Amster 20 Dec. 1968 9 p
(Contract AT(11-1)-34)
(UCB-34P161-1) Avail: CFSTI

Development of a set of leakage spectrometers with calculated properties is reported. The spectrometers consist of small spherical epithermal resonance absorbers at the core of a BCOVERED POLYETHYLENE SPHERE. Because of the effects of leakage and moderation in the polyethylene, the cores will have different activation energy dependencies peaking in the kilovolt range. The experimental configuration at the University of California TRIGA reactor is described. NSA

**N69-38313#** Oak Ridge National Lab., Tenn.
**BULK SHIELDING FACILITY Quarterly Report, Jan. - Mar. 1969**
W. H. Tabor and S. S. Hurt 7 May 1969 101 p *ref*
(ORNL-TM-2600) Avail: CFSTI

The BSR operated at an average power level of 1943.5 kw for 75.7% of the time during January, February, and March of 1969. Water quality control in both the reactor primary and secondary cooling systems was very satisfactory. There were four unscheduled shutdowns, all caused by shim rods dropping; two were caused by the No. 4 shim rod, one by No. 1 shim rod, and one by No. 2 shim rod. Minor troubles experienced in the nuclear and process instrumentation were as follows: failure of three composite amplifiers and one magnet amplifier; one shim-rod seat switch failure; failure of two shim-rod-clutch switches; failure of the slip coupling on the north cooling fan; failure of a condenser in the pH indicator for the secondary water cooling system; and failure of the No. 1 safety chamber. Author (NSA)

**N69-38323#** Atomics International, Canoga Park, Calif.
**LARGE RADIOISOTOPE HEAT SOURCE CAPSULE (LRHSC) Quarterly Progress Report, Jan. – Mar. 1969**
1 May 1969 72 p
(Contract AT(29-2)-2338)
(AI-AEC-12823; QPR-7) Avail: CFSTI

Special design modification for assembly of the instrumented fire test capsule was completed. Weld development of the 0.09 in. wall and the 0.10 in. wall T-111 structural shell to the T-111 structural end cap was completed. Fabrication of seven Pt-Rh barrier caps was completed. Assembly was completed of one impact capsule, three creep test capsules, creep capsule C standard, and the LRHSC fire test capsule. The original B5 capsule designated for strain rate testing was redesignated as a rupture capsule. The total diametral strain at the time of rupture was nearly 15%. The B7 capsule achieved 5% total strain. B6 capsule testing continues and creep capsule B-4a was tested to 5% strain in 195 hours. Fabrication of a new barrel for the Impact Facility to allow hot breech loading and testing without the graphite sabots and stripper previously employed was completed and the barrel installed. A launch abort fire test capsule of the LRHSC creep C configuration was assembled, instrumented, and successfully tested. NSA

**N69-38326#** Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
**PROPERTIES OF TUNGSTEN AND TUNGSTEN ALLOYS FOR REACTOR SHIELDING APPLICATIONS**
T. D. Watts 19 Jun. 1969 22 p refs
(Contract W-7405-ENG-26)
(Y-1675) Avail: CFSTI

Data and information on the chemical, physical, and mechanical properties of unalloyed tungsten and its nickel-iron alloys that pertain to using these materials for reactor shielding have been collected. The normal fabrication techniques and commercial availability are described. Since much of the data were obtained by an extensive literature search, the main references, from which this compilation was made, are included. Most of the information on the tungsten-nickel-iron alloys has come from heretofore unpublished work. Author (NSA)

**N69-38329#** United Kingdom Atomic Energy Authority, Dounreay (Scotland).
**IMPROVEMENTS IN DOSIMETRY FOR EXPERIMENTS IN DIDO-TYPE MATERIALS TESTING REACTORS**
E. W. Etherington 28 Nov. 1968 19 p refs
(TRG-Report-1754) Avail: CFSTI

Radiation doses for experiments in materials testing reactors are normally measured in terms of the $^{58}Ni(n,p)^{58}Co$ reaction and the gamma heating rates in a material such as Al or graphite. The effectiveness of such dosimeters is critically assessed for two types of experiment: radiation damage in metals, and aqueous radiation chemistry. A number of suggestions are made for improving dosimetry measurements. Author (NSA)

**N69-38338#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**NONDESTRUCTIVE ANALYSIS OF FUEL IRRADIATED IN THE EBWR BY GAMMA SCANNING**

F. S. Murphy, G. Mance, and D. E. Christensen. Apr. 1969. 87 p. (Contract AT(45-1)-1830) (BNWL-1005) Avail: CFSTI

This nondestructive method provided valuable data about the performance of the plutonium enriched fuel as a function of exposure. A large part of the data is relative count rates, taken with a NaI(Tl) detector and presented to indicate: the relative power generation profiles of $UO_2$ - 1.5 wt% $PuO_2$, Al - 3.35 wt% $PuO_2$, and natural $UO_2$ fuel rods at varying exposures; the relative power generation profile of a fuel element as well as the profile of the plutonium enriched region of the core as a function of exposure; changes to power generation profiles and how the changes correlate to reactor operating history, i.e., power level changes and control rod movements; core symmetry; performance characteristics of different nuclear fuels irradiated in the same environment with the same power history; and the contribution to the total gamma activity measured outside an intact fuel element from each rod in a six rod column inside the element. Author (NSA)

**N69-38337#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**MICROSTRUCTURES OF DEFORMED ALPHA PLUTONIUM**
R. D. Nelson and S. D. Dahlgren. Apr. 1969. 13 p. refs. (Contract AT(45-1)-1830) (BNWL-981) Avail: CFSTI

The effect of temperature, strain rate, and total strain on the deformation mode of high purity cast alpha plutonium was determined. Deformation was predominantly by grain boundary sliding at 110°C and at a strain rate of $10^{-4}$ per min, whereas slip was the major deformation mode at -10°C and $10^{-1}$ per min. Deformation at intermediate temperatures and strain rates was by a mixture of grain boundary sliding and slip. Recrystallization occurred concurrently with deformation only after a critical strain was reached. The critical strain decreased with increasing temperature and was independant of strain rate in the range of $10^{-1}$ to $10^{-4}$ per min. Strains of 14, 6, and 3% were required at 105, 110, and 120°C, respectively, before recrystallization started. Deformation by twinning was insignificant. Author (NSA)

**N69-38338#** General Electric Co., Schenectady, N.Y. Research and Development Center.
**HIGH-PURITY GERMANIUM FOR GAMMA DETECTORS Annual Report, May 1968 - Apr. 1969**
R. N. Hall, R. D. Baertsch, and T. J. Soltys. May 1968. 4 p. (Contract AT(30-1)-3870) (NYO-3870-2; AR-2) Avail: CFSTI

Progress in the purification of germanium and the fabrication of p-i-n junctions for gamma detection is summarized. Author (NSA)

**N69-38345#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**ANALYSIS OF FTR PHASE A CONTROL ROD EXPERIMENTS IN ZPR-3, ASSEMBLY 48 AND 48-A**
R. A. Bennett and S. L. De Meyer. Apr. 1969. 54 p. refs. (Contract AT(45-1)-1830) (BNWL-967) Avail: CFSTI

Critical experiments in support of the design of the fast flux test reactor are to be carried out in three parts. Control rod reactivity worths and rod interactions are analyzed. The results of an analysis of the data obtained on ZPR-3 assemblies 48 and 48A are presented. Author (NSA)

**N69-38351#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**ESTIMATION OF MOLTEN CORE SIZE IN WASTE STORAGE VESSELS AND FROZEN WALL WASTE MELTERS**
J. D. Kaser. Apr. 1969. 8 p. ref. (Contract AT(45-1)-1830) (BNWL-1004) Avail: CFSTI

Equations for calculating the size of molten cores in cylindrical and spherical vessels containing highly radioactive heat-generating waste are derived. These equations may be used for cases where (1) all heat is generated by radioactive decay, and (2) internal heaters supply heat in addition to the radioactive decay heat. Author (NSA)

**N69-38367#** Oak Ridge National Lab., Tenn.
**HIGH FLUX ISOTOPE REACTOR Quarterly Report, Jan.-Mar. 1969**
R. V. Mc Cord and B. L. Corbett. 5 May 1969. 22 p. ref. (ORNL-TM-2606) Avail: CFSTI

Operation of the high flux isotope reactor for the quarter January 1 through March 31, 1969, is summarized. Reactor operation was routine and an operating time percentage of 90% was achieved despite the installation of two major experiments into the reactor and the subsequent failure of one of them. Author (NSA)

**N69-38378#** California Univ., Livermore. Lawrence Radiation Lab.
**MAGNETIC PULSER FOR PAM MULTIPLEXED INSTRUMENTATION POWERED AND TIMED FROM 10 KHz 3 PHASE AC**
Kris Aaland and Glynn A. Pence. Apr. 1969. 27 p. ref. Sponsored by AEC (UCRL-71574) Avail: CFSTI

An all magnetic pulser for multiplexing 80 transducers was developed. Three groups power 240 transducers with a 0.3-μs wide pulse in a repetitive pattern every 50 μs, hence has a combined group rate of $4.8 \times 10^6$ amplitude modulated pulses per second. Power and timing are provided by a 10-kHz, 3-phase ac line. The pulse forming network, connected between part of the magnetic pulser and transducer it drives, is effected by a modified Melville line which incorporates a 30-meter long transmission line. The magnetic pulser provides reliable operation in a hazardous (radiation) environment and replaces an earlier unit which required thousands of transistors. The magnetic pulser is a further step in the evolution of design using saturable reactors. Author (NSA)

**N69-38380#** Oak Ridge National Lab., Tenn. Operations Div.
**EXPERIMENTAL DETERMINATION OF THE DIFFERENTIAL FAST NEUTRON FLUX IN THE HIGH FLUX ISOTOPE REACTOR USING THRESHOLD DETECTORS**
Harold Lebron Dodds, Jr. May 1969. 141 p. refs. (Contract W-7405-eng-26) (ORNL-TM-2585) Avail: CFSTI

The differential fast neutron flux above 0.5 MeV at one spatial position in the High Flux Isotope Reactor is determined experimentally using several threshold activation detectors. The series expansion technique utilizing the concept of least squares is used to obtain an approximate solution to the set of integral equations which are defined by experimentally determined activation data. The results which are presented include several different sets of activation data so that the effect of discrepancies in the experimental measurements on the computed differential flux spectra may be observed and evaluated. Author (NSA)

**N69-38386#** Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
**SNAP 23A, PHASE 1 Quarterly Progress Report, 1 Dec. 1968 - 28 Feb. 1969**
W. S. Wilgus. 20 Mar. 1969. 116 p. refs. (Contract AT(30-1)-3800) (WANL-3800-28; WANL-PR-SS-25) Avail: CFSTI

The use of $SrTiO_3$ fuel capsule instead of an electrical heater in the PMS was recommended. Thermal and mechanical tests of the EMS have been completed. The Fueled Prototype Mockup System (FPMS) design is being reviewed and materials selec-

tion begun. The (F)PMS/PMC-2 design point selection was made corresponding to a maximum BOL hot junction temperature of 1040°F with an increase in ambient temperature capable from 70 to 100°F in this design. Data are presented for the spherical insulation tests using Min-K 2000 and Min-K 2002. Thermal grease testing results are given. Safety analyses, specifically on the loss-of-radiator accident, on internal heat source material requirements were investigated. NSA

**N69-38388#** Bettis Atomic Power Lab., Pittsburgh, Pa.
**PLANETARY BALL MILLING AS A METHOD OF COMMINUTING PRESINTERED THORIA-URANIA GRANULES (LWBR DEVELOPMENT PROGRAM)**
T. J. Burke Apr. 1969 26 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-789) Avail: CFSTI

Planetary ball milling was investigated as a method of comminuting presintered thoria ($ThO_2$)-uranie ($U^{E}O_2$) granules for the preparation of sinterable feed powders. The experimental results indicated that planetary ball milling offers significant size-reduction rate advantage over conventional wet ball milling. $ThO_2$ + 5.1 and 7.9 wt% $U^{E}O_2$ powders, with a sinterability equivalent to that of powders conventionally wet ball milled for 44 hours, were produced by wet planetary ball milling for 4 hours. Although planetary ball milling offers a distinct advantage in milling time of $ThO_2$–$U^{E}O_2$ powders over that of conventional wet ball milling, it contaminates the powders with iron to a level that requires acid leaching of the powders to assure an acceptable iron content in the sintered pellets. Author (NSA)

**N69-38395#** Sandia Corp., Albuquerque, N.Mex. Test Effects Dept.
**ACOUSTIC WAVE EFFECTS PROJECT: AIRBLAST PREDICTION TECHNIQUES**
Jack W. Reed May 1969 97 p refs Sponsored by AEC
(SC-M-69-332) Avail: CFSTI

Atmospheric lens effects can cause strong propagation of blast waves to great distances. This problem is reviewed and current best estimates of the pertinent parameters for predicting longrange propagations from nuclear cratering explosions are given. Definitions are given to concepts of standard explosion waves, underground burst transmission factors, row-charge effects, atmospheric focus factors, and damage estimators. Author (NSA)

**N69-38397#** Skoda Works, Plsen (Czechoslovakia). Nuclear Power Plant Dw.
**INTERACTION OF THERMAL RADIATION WITH FREE CONVECTION HEAT TRANSFER IN A CLOSED CAVITY**
Ladislav Pecinka Oct. 1968 18 p refs
(ZJE-29) Avail: AEC Depository Libraries

The effects of thermal radiation on natural convection heat transfer in a gas-cooled, heavy-water moderated reactor with a vertical arrangement of pressure tube channels were analyzed. The conductive and laminar heat transfer regimes were studied for an analysis of the insulation provided by a gas layer of a multilayer region. The conductive regime of the lowest losses by heat dissipation into the moderator was studied at $t \sim 0.2$ mm for insulating gas with normal parameters. For currently used thickness of insulating space, the laminar conductive regime was attained. The conductive regime was presumed to be in individual layers. Based on the knowledge of the temperature profile of layers, the radiation flux may be determined. NSA

**N69-38425#** Gulf General Atomic, San Diego, Calif.
**MICA FOIL TECHNIQUE FOR DETERMINING FUEL PARTICLE COATING CONTAMINATION**
K. P. Steward 20 Mar. 1969 44 p refs
(Contract AT(04-3)-633)
(GAMD-9015) Avail: CFSTI

A mica foil technique for revealing coating contamination in nuclear fuel particles has been developed. The technique is described together with problems encountered during development. The method has been applied to studies of uranium contamination in coatings on TRISO-I and TRISO-II particles, and in the PyC coatings of fuel production division (F.O.D.) TRISO-II fertile particles. The mica foil technique is a very sensitive method of determining uranium contaminations; results obtained using this method are in good agreement with values determined by other methods. Permanent photographic records of contamination in individual particles can be produced using the method and it is relatively fast, easy, inexpensive, and is the only sensitive way of comparing contamination and contamination distributions in different particles from the same batch, and of investigating contamination in individual particles. Author (NSA)

**N69-38426#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**DRY WHEEL CENTERLESS GRINDER FOR DEVELOPMENT LABORATORY USE**
J. L. DeMeyer Apr. 1969 10 p
(Contract AT(45-1)-1830)
(BNWL-1052) Avail: CFSTI

A grinding device was designed and constructed for glove box use as an inexpensive and simple means of making small reductions in the diameter of $PuO_2$–$UO_2$ pellets which are used in fuel elements. The device is used in dry grinding to eliminate pellet contamination. In combining the grinder with a Syntron rotary vibration feeder, 1200 to 1800 pellets per hour can be produced while removing 0.002 to 0.004 in. on the diameter. Diametral tolerance can be held to 0.0002 in. on a 0.200 in. diameter pellet. NSA

**N69-38439#** California Univ., Berkeley.
**NEUTRON SPECTRUM MEASUREMENTS Progress Report, Apr. 1969**
Harvey Amster 1 Apr. 1969 4 p
(Contract AT(11-1)-34)
(UCB-34-P181-2) Avail: CFSTI

Progress in the selection of materials and geometry for the development and testing of leakage spectrometers is presented. Calculations are included for the substitution of Au for a Mn resonance absorber. Preparations for the calibration experiment are described. NSA

**N69-38446#** Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
**SAVANNAH RIVER LABORATORY ISOTOPIC POWER AND HEAT SOURCES. PART 1: COBALT-60 Quarterly Progress Report, Jan.–Mar. 1969**
H. S. Hilborn, comp. Apr. 1969 25 p refs
(Contract AT(07-2)-1)
(DP-1196-1) Avail: CFSTI

Fabrication procedures are being developed to provide high density wafers of CoO, (Co,Mg)O, and $CoAl_2O_4$ for irradiation tests and evaluation as high melting, oxidation resistant heat source fuels. Haynes 25 will be the preferred capsule alloy for most uses of $^{60}Co$ at temperatures to 1000°C. Inactive capsules of Haynes 25 increased uniformly in diameter by 0.006 and 0.008 inch in 10,000 hour tests at 1000°C. This increase is consistent with the density change associated with the cobalt phase transformation above 417°C. A preliminary scope of work was completed for a new facility for $^{60}Co$ capsule testing. Initial tests were run to measure the compatibility of molten cobalt with tungsten. Selection of techniques and equipment for welding refractory alloy capsules for SRL tests was begun. Author (NSA)

**N69-38462#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**ETOX: A CODE TO CALCULATE GROUP CONSTANTS**

**FOR NUCLEAR REACTOR CALCULATIONS**
R. E. Schenter, J. L. Baker, and R. B. Kidman May 1969 54 p refs
(Contract AT(45-1)-1830)
(BNWL-1002) Avail: CFSTI

Computer code ETOX (ENDF/B TO 1DX) calculates group constants for reactor calculations from currently available nuclear data. The code is specifically designed to use the Evaluated Nuclear Data File (ENDF/B) as input for microscopic cross section values. Output from this code includes punched cards in the Bondarenko format which can be used as input to the fast reactor codes FCC-IV and 1DX. Running time on a UNIVAC 1108 computer ranges from 13 to 600 sec per isotope. The current version of ETOX is restricted to a maximum of 99 energy groups.
Author (NSA)

**N69-38463#** General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
**THERMODYNAMIC ANALYSIS OF POSSIBLE CHEMICAL INTERACTIONS IN THE SYSTEM: UO-2 PuO-2 FUEL-SODIUM-STAINLESS STEEL**
E. A. Aitken Jul. 1968 61 p refs
(Contract AT(04-3)-189
(GEAP-5683) Avail: CFSTI

Results of a literature search on the possible reactions between Na, fuel, and cladding are presented. An analysis of thermal gradient effects on the fuel and cladding phases is presented and a number of mechanisms for predicting material flow in thermal gradients are described. The magnitude of thermally induced sodium-fuel reactions resulting in fuel swelling is evaluated and conditions useful in controlling such reactions are described. The mechanisms of cladding oxidation by hyperstoichiometric fuels are analyzed. Recommendations for research on aspects of Na-fuel-cladding compatibility are included. Author (NSA)

**N69-38464#** Gulf General Atomic, San Diego, Calif.
**ON THE 40 MW(e) PROTOTYPE HIGH-TEMPERATURE GAS-COOLED REACTOR POSTCONSTRUCTION RESEARCH AND DEVELOPMENT PROGRAM Quarterly Progress Report for the Period Ending 30 Apr. 1969**
29 May 1969 59 p
(Contract AT(04-3)-314)
(GA-9360) Avail: CFSTI

An ongoing research and development program at the Peach Bottom Power Reactor is described in the postconstruction phase. For Unit 1, the following topics were investigated during the four-month period, January to April 1969: (1) the effects of the power level of Unit 1 coolant on the content of krypton-85, krypton-87, krypton-88 and krypton-89 isotopes, on the content of strontium-90 isotopes, and on the contant of xenon-135 and xenon-138 isotopes; (2) the effects of dimensional changes in the reactor fuel elements on the failure of Reactor Unit 1; (3) the measurement of fast neutron radiation effects on dimensional changes in the reactor; and (4) the calibration of the reactivity worth of the Peach Bottom Reactor Unit 1 fuel elements.
M.H.E.

**N69-38468#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**PRELIMINARY ANALYSIS OF POSTULATED MAXIMUM ACCIDENTS FOR THE FFTF. SUPPLEMENT 1: ADDITIONAL CALCULATIONS FOR SODIUM-IN CONDITIONS**
R. A. Harris Dec. 1968 48 p refs
(Contract AT(45-1)-1830)
(BNWL-760-Suppl 1) Avail: CFSTI

The core disassembly calculations reported in BNWL-760 for the particular case of sodium-in conditions are reevaluated. The validity of the sodium-in equation of state used in the referenced document is reexamined, and a newly developed expression, based on experimental data in the temperature domain of interest, is presented. The effect of Na vapor pressure as a disassembly force and the effects of Na compressibility are parametrically examined. The analysis indicates that the disassembly calculations reported in BNWL-760 for sodium-in conditions are probably quite pessimistic. However, a reevaluation of the effects of sodium prior to and following the disassembly phase may be necessary before one can confidently recommend energy release values which are substantially lower than those previously reported.
Author (NSA)

**N69-38472#** Oak Ridge National Lab., Tenn.
**EFFECT OF ALLOYING ADDITIONS ON CORROSION BEHAVIOR OF NICKEL-MOLYBDENUM ALLOYS IN FUSED FLUORIDE MIXTURES. VOLUME 1**
Jackson Harvey De Van (M.S. Thesis, Tennessee Univ., Knoxville)
May 1969 45 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2021-Vol-1) Avail: CFSTI

Fused fluoride mixtures containing $UF_4$ have been developed as fuel solutions for high-temperature nuclear reactors. To develop container materials for such mixtures, the corrosion properties of nickel-molybdenum alloys with various solid-solution strengthening additions were investigated. These evaluations utilized thermal convection loops which circulated salt mixtures between a hot-zone temperature of 816°C and a cold-zone temperature of 650°C. The alloys selected for study contained 17 to 20% Mo and various percentages of Cr, Al, Ti, V, Fe, Nb, and W. Loops of individual alloys were exposed to the salt mixture NaF-LiF-KF-$UF_4$ (11.2-45.3-41.0-2.5 mole%) for periods of 500 and 1000 hr. Measurements of the concentrations of corrosion products in after-test salt samples indicated the corrosion susceptibility of alloying additions to increase in this order: Fe, Nb, V, Cr, W, Ti, and Al.
Author (NSA)

**N69-38478#** Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
**UNSTEADY MOMENTUM FLUXES IN TWO-PHASE FLOW AND THE VIBRATION OF NUCLEAR REACTOR COMPONENTS**
Tien Sieh Yih and Peter Griffith Nov. 1968 126 p refs
(Contract AT(30-1)-3486)
(DSR-70318-58) Avail: CFSTI

The steady and unsteady components of the momentum flux in a two-phase flow were measured at the exit of a vertical pipe. Data were machine processed by standard random vibration techniques to obtain the power spectral density curves. From these curves, the predominant frequency and the rms value of the unsteady momentum flux were obtained. The effects of the average flow velocity, volumetric quality, system pressure, flow channel size, and geometry on the unsteady momentum fluxes, were observed. It was found that the fluctuation of momentum fluxes is important only in the low frequency range. In the sample problems, using the experimental results, the effect of the unsteady momentum fluxes on a steam generator U-tube and a reactor fuel rod were studied. The amplitudes of the structural vibrations resulting from the two-phase excitation were found. In addition, it was also found that there is a possibility of unstable vibrations owing to a nonlinear restoring force on the mechanical system.
Author (NSA)

**N69-38486#** Idaho Nuclear Corp., Idaho Falls.
**CLARIFICATION OF ELECTROLYTIC DISSOLVER SOLUTION USING A HYDROCYCLONE**
D. H. Cranney, M. E. Jacobson, and B. C. Musgrave Apr. 1969 14 p refs
(Contract AT(10-1)-1230)
(IN-1276) Avail: CFSTI

Four laboratory-scale hydrocyclones were evaluated for their efficiency in clarification of product solution from electrolytic dissolution of EBR-2 fuel. Ninety-five percent removal of stainless steel solids from the overflow stream was demonstrated at 43 psi

pressure drop through a hydrocyclone which was 38 mm in diameter and 264 mm long. At these same conditions, 10% removal of EBR-2 fission alloy residues was attained. Author (NSA)

**N69-38486#** Iowa State Univ. of Science and Technology, Ames.
**LIQUID-METAL CORROSION EFFECTS OF IRON ADDITIONS ON URANIUM-CHROMIUM EUTECTIC IN YTTRIUM**
Robert James Cash Feb. 1969 195 p refs
(Contract W-7405-eng-82)
(IS-T-299) Avail: CFSTI

The results of corrosion tests with two proposed liquid-metal reactor fuels, uranium-5.0 wt % chromium eutectic and uranium-chromium-iron, contained in yttrium are presented. Based on results of differential thermal analyses and metallographic examinations, the existence of the ternary eutectic point in the uranium-chromium-iron system was tentatively identified at uranium-2.5 wt % chromium-2.5 wt % iron melting at 765°C. This is contrary to published data. A partial phase diagram was constructed for the uranium-chromium eutectic versus iron system using thermal analysis data. The dissolution-rate constant for yttrium in the uranium-chromium eutectic at 950°C was determined to be 0.0138 cm/min. The results of the corrosion tests with uranium-chromium eutectic and the uranium-chromium-iron alloys showed that yttrium was not a satisfactory long-term container metal at 950°C and above. Author (NSA)

**N69-38494#** Rensselaer Polytechnic Inst., Troy, N.Y.
**LINEAR ACCELERATOR PROJECT Progress Report, 1 Oct.-31 Dec. 1968**
31 Dec. 1968 54 p refs
(Contract AT(30-3)-328)
(RPI-328-148) Avail: CFSTI

Progress on specific projects related to linear accelerator research is reported. Topics include: (1) neutron cross section studies involving capture and transmission measurements in various isotopes, neutron resonances in Pm 148 and Pu 239, total cross sections for Hf isotopes, and testing of a prototype MeV neutron detector; (2) theoretical and experimental investigations in fast reactor physics; (3) low-energy neutron inelastic scattering research; and (4) development of data acquisition programs for the PDP-7 computer. A.C.R.

**N69-38496#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**PREPARATION, GENERATION, AND ANALYSIS OF GASES AND AEROSOLS FOR THE CONTAINMENT SYSTEMS EXPERIMENT**
L. F. Coleman Apr. 1969 95 p refs
(Contract AT(45-1)-1830)
(BNWL-1001) Avail: CFSTI

Methods for the preparation, isotopic labeling, and release of aerosols to containment systems are presented. A description of sampling methods and hardware is also presented along with a discussion of gamma energy analytical techniques employed. The systems and techniques discussed were developed in support of a Reactor Safety Program (Containment Systems Experiment) which will furnish engineering scale data on the behavior of aerosols in reactor containment systems. Author (NSA)

**N69-38499#** Atomic Energy Establishment, Winfrith (England).
**THERMAL DECOMPOSITION OF A LOW-VISCOSITY EPOXY RESIN**
W. F. Fortescue, R. P. Overend, and G. B. Redding July 1968 17 p refs
(AEEW-M-831) Avail: CFSTI; UK

In order to assess the consequences of overheating an experimental reactor fuel plate containing a low viscosity epoxy resin (Araldite), the thermal decomposition of this material was studied with respect to the kinetics and gas evolution. The decomposition occurred as a series of reactions, the major two reactions being first order with high activation energies. The maximum prolonged temperature was 260°C; at 300°C the half life of decomposition was approximately 3 hours, and only 0.1 second at 500°C. The quantity of gas evolved was ≈20 $cm^3$ (stp) $gram^{-1}$ at 500°C and consisted of carbon dioxide, carbon monoxide, and small organic molecules. Author (NSA)

**N69-38505#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
**POTENTIAL OF USING MIXED FISSION PRODUCTS AS A SOURCE OF ENERGY**
D. W. Bolme Jun. 1969 54 p refs
(Contract AT(45-1)-1830)
(BNWL-1115) Avail: CFSTI

The amount of mixed fission products (waste byproducts obtained in the chemical reprocessing of nuclear fuels) potentially available through the year 2000 was estimated, their probable characteristics when packaged in a form suitable for long term storage described, and the potential usefulness of these packages as sources of thermal and gamma (radiation) energy assessed. The amounts potentially available depend upon the development of the nuclear (electric) power industry. Initial availability could be as early as 1975, substantial amounts (4800 packages per year) are expected to be available in about 1980. Packaging the waste will consist of converting the waste to a solid and depositing the solid in a metal cylinder which would then be welded shut. Author (NSA)

**N69-38507#** Atomics International, Canoga Park, Calif.
**LARGE RADIOISOTOPE HEAT SOURCE CAPSULE PROGRAM. TOPICAL REPORT NO. 6: CAPSULE FABRICATION AND ASSEMBLY PROCESSES**
V. D. Melillo 31 Mar. 1969 97 p
(Contract AT(29-2)-2338)
(AI-AEC-12822) Avail: CFSTI

The Large Radioisotope Heat Source Capsule (LRHSC) program for the development of the technology for a high temperature (≥2000°F), long life (≥5 years) radioisotope heat source which can be used in the space environment is discussed. The program is concerned with the development of a tantalum alloy fuel capsule. Materials compatibility, fabrication processes, and assembly procedures are being defined and the response of the capsule is being determined for conditions of biaxial creep, terminal velocity impact, and burial. A description of LRHSC fabrication and assembly procedures is given. Fabrication details are presented for each of the capsule piece-parts with the exception of the T-111 structural shell, the fabrication of which was previously given. Cleaning and annealing practices for the capsule piece-parts are described and the capsule assembly procedures are detailed. Author (NSA)

**N69-38508#** Los Alamos Scientific Lab., N. Mex.
**RADIATION LEAKAGE THROUGH PINHOLE COLLIMATORS**
B. M. Moore Feb. 1969 5 p refs
(Contract W-7405-ENG-36)
(LA-4121) Avail: CFSTI

A method is described for determining the increased signal from a point source due to radiation leakage through the sides of a pinhole collimator. The method enables quick estimates of the leakage, with fairly small uncertainties, for many source, collimator, and detector systems. Author (NSA)

**N69-38509#** Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Heisse Chemie.
**POLAROGRAPHIC INVESTIGATION OF AUTOMATIC DETERMINATION OF URANIUM IN FUEL SOLUTION**
D. Thiele and G. Baumgaertel Feb. 1969 20 p refs In GERMAN
(KFK-869; EUR-4158) Avail: AEC Depository Libraries

For the development of a derivative polarographic on-line analysis of Purex solutions for uranium, the disturbing influences of tributyl phosphate and ruthenium were investigated. The half-wave potentials of ruthenium nitrosyl nitrates, ruthenium(IV) nitrates, and ruthenium(III) chlorides were determined in 1.4 and 3.0M nitric acid in the presence and absence of TBP. The diffusion current of uranium showed a linear dependence on concentration in the presence of ruthenium and TBP. The standard deviation, calculated from 8 determinations, amounted to 2.2%. Author (NSA)

**N69-38512#** Atomic Energy Commission, New York. Health and Safety Lab.
**FEASIBILITY STUDY OF USING LiF DETECTORS IN A NEUTRON FLUX GENERATOR**
Arthur S. Lazanoff and James E. McLaughlin Mar. 1969 28 p refs
(HASL-208) Avail: CFSTI

In place of the widely used $^{59}Co$ disks, thermoluminescent LiF detectors were exposed inside a flux moderator to known Pu-Be neutron fluences to determine the correlation between the detector light output and the exposure. LiF in the powdered form produced a thermoluminescent output that was linear with respect to an exposure range from $10^6$ to $10^8$ n/cm$^2$. Solid LiF squares were less sensitive than the powder, and their response was nonlinear. A theoretical neutron energy response function from Bonner sphere data was derived and it was found that the neutron response of the detector can vary as much as a factor of two when exposed to different neutron energy spectra. To infer accelerator or reactor stray radiation dose information, further experimental work is planned on energy response and on neutron and gamma-ray discrimination. Author (NSA)

**N69-38513#** Scientific Translation Service, Ann Arbor, Mich.
**OPTICAL METHOD FOR THE DETERMINATION OF THE LOCAL ANISOTROPY OF PYROLYTIC CARBON LAYERS AND GRAPHITE**
H. B. Gruebmeier and G. P. Scheidler [1968] 17 p refs Transl. into ENGLISH from a German Paper Submitted for Publ. Sponsored by AEC. Prepared for ORNL
(ORNL-TR-2127) Avail: CFSTI

The anisotropic structure of pyrolytic carbon on coated particles to be used in nuclear fuel elements can be determined by an optical method which measures the intensity of reflected polarized light in two perpendicular directions with a microscope photometer. The degree of orientation can be described by an optical anisotropy factor, which is related experimentally to the BACON anisotropy factor. A theoretical relation has been found between the optical anisotropy factor, the orientation parameter of BOKROS and the BACON anisotropy factor, which fits the experimental values. Author (NSA)

**N69-38530#** Mainz Univ. (West Germany). Inst. fuer Anorganische Chemie und Kernchemie.
**INSTITUTE FOR INORGANIC AND NUCLEAR CHEMISTRY Annual Report, 1967**
Sep. 1968 130 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-68-44) Avail: AEC Depository Libraries

The report is composed of the following parts: performance of a Triga reactor and Cockcroft–Walton accelerator; rapid chemical separations; decay properties of short-lived neutron-rich nuclei; mass- and charge-distribution in fission; and counting techniques. Author (NSA)

**N69-38536#** Rolls-Royce, Ltd., Derby (England).
**PRECISION MANUFACTURE OF NUCLEAR COMPONENTS**
A. P. W. Burrows 1968 5 p Presented at the BNES/BNF Nucl. Power Meeting, Copenhagen
(CONF-680825-4) Avail: AEC Depository Libraries

The limits, tolerances, and specification requirements of nuclear components for the civil reactor field are discussed, and the cost is related to the technical requirements. A number of examples of the limits worked to in nuclear component manufacture are given. The relationship of the designer to the manufacturer as it affects performance of the component in the plant, and the cost effect of correct interpretation by both parties is outlined. NSA

**N69-38547#** Institute of Nuclear Research, Warsaw (Poland).
**AN ANALOG STUDY OF STEADY AND UNSTEADY STATE TEMPERATURE DISTRIBUTIONS IN A BERYLLIUM BLOCK IN REACTOR CORE**
Andrze Strupczewski 1968 38 p refs
(INR-961) Avail: AEC Depository Libraries

The solution of a heat conduction problem in a beryllium moderator block of a nuclear reactor under steady state and transient conditions is presented. The temperature distributions in the block have been computed for the case of the sudden increase of reactivity and the corresponding increase of internal heat sources. The temperature dependence of thermal conductivity and heat capacity of beryllium has been taken into account as well as the temperature dependence of the boundary conditions. An accuracy of about 2% has been achieved. Author (NSA)

**N69-38563#** Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorbauelemente.
**TEMPERATURE AND STRESS DISTRIBUTIONS IN FUEL ROD CLADS WITH SPIRAL SPACERS FOR STEAM-COOLED FAST BREEDERS**
H. Hoofman et al [1969] 80 p refs Transl. into ENGLISH of *Its* Report KFK-905 Prepared under US-Euratom Fast Reactor Exchange Program
(EURFNR-907; EUR-3965d; KFK-905) Avail: CFSTI

The temperature distributions and stresses in spiral-spacer clads are mainly influenced by the spacer geometry, the local heat transfer conditions, and operating conditions. The tubes were still more strongly stressed in the immediate vicinity of spacers than cylindrical tubes. The number of fins is of subsidiary importance in establishment of maximum temperatures. However, 6 fins per rod give slightly smaller reference stresses than 3 fins. Results of various testing conditions and configurations are presented. 11 references. Author (NSA)

**N69-38581#** Stanford Linear Accelerator Center, Calif.
**SLAC SPIRAL READER SYSTEM**
Michael J. C. Hu May 1969 6 p refs Presented at the DECUS Symp., Maynard, Mass., Spring 1969 Supported by AEC
(SLAC-PUB-593; CONF-690510-2) Avail: CFSTI

The spiral reader is a semiautomatic film digitizing machine developed by the Alvarez Physics Group at the Lawrence Radiation Laboratory at Berkeley. It is used to measure photographs of elementary nuclear particle interactions which are created in a hydrogen bubble chamber. The entire man-machine-computer has proven to be accurate and reliable on the digitization. At Stanford Linear Accelerator Center (SLAC) a modified spiral reader was built to measure bigger areas, and to handle different film formats. A PDP-9 computer was selected to control and to acquire data. Practically every I/O feature on the PDP-9 was used to minimize external electronic interface and to make the control program more efficient. The PDP-9 computer performs the following functions: It guides the operator through the measuring sequence and types out warning messages on the teletype if the operator makes an error. Author (NSA)

**N69-38583#** Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.
**GEL-ADDITION PROCESS CHEMICAL STUDIES Quarterly Progress Report, Nov. 1968 – Jan. 1969**
E. H. Dewell, comp. Jun. 1969 65 p refs
(Contract AT(30-1)-3714)
(BAW-3714-12) Avail: CFSTI

The preparation of (U, 20% Pu)$O_2$ sol-gel spherical fuel in two size ranges for thermal reactor testing is complete. Two uranium enrichments—depleted $UO_2$ and 20% enriched $^{235}UO_2$—were used to prepare materials that will yield two different heat rates with fuel of the same U/Pu ratios. Also completed is the first irradiation capsule test in a series designed to show differences in the restructuring kinetics of pellets and vibratory compacted spheres and shards; the heat rate was 16.7 kW/ft. and the capsule received 9.3 EFPD. The capsule is cooling pending hot cell examination. The procedures for moisture determination and oxygen stoichiometry in mixed oxide fuels are summarized. Measurements of the gas contents and densities of irradiation specimens are complete. A stainless steel and Homalite glove box for examination of subkilo quantities of reactor-exposed plutonium-bearing fuels is described. The equipment hot cell and laboratory used for the sol-gel process are also discussed. Author (NSA)

**N69-38570#** Atomic Energy of Canada, Ltd., Chalk River (Ontario). Fuel Materials Branch.
**STUDY OF THE OPTIMIZED CONDITIONS FOR FABRICATION OF URANIUM DIOXIDE PELLETS BY PRESSING [ETUDE DES CONDITIONS OPTIMALES DE MISE EN FORME PAR PRESSAGE DU BIOXYDE D'URANIUM]**
A. Ledac June 1969 21 p refs Transl. into ENGLISH from CEA Report
(AECL-3373; CEA-DM/1741) Avail: CFSTI

Circumferential cracking at and near the end faces was encountered in $UO_2$ pellets. To determine the cause of these faults, the following parameters were investigated: (1) the clearance between plunger and die during pressing, (2) the pressing pressure, and (3) the type of $UO_2$ powder used (prepressed granulated powder vs as-received powder). The faults were attributed to excessive clearance between the plunger and die, and became more extensive as the pressing pressure increased, independently of the type of powder used. Satisfactory pellets were produced at a plunger and die diameter clearance of 0.03 mm. Author

**N69-38582#** Los Alamos Scientific Lab., N. Mex.
**THE RADIATION INSTRUMENT CALIBRATION FACILITY AT THE LOS ALAMOS SCIENTIFIC LABORATORY**
R. W. Davis and E. R. Graves 24 Jun. 1969 117 p refs
(Contract W-7405-ENG-36)
(LA-4090) Avail: CFSTI

The radiation instrument calibration facility consists of six vertical shielded tubes of which three contain $^{60}Co$, one $^{226}Ra$, and one $^{239}Pu$-Be neutron sources, mounted on elevator mechanisms. The sixth tube is for experimental source use. The gamma sources, which range from 2 mCi to over 300 Ci, produce exposure rates of from 0.145 mR/h to 3391 R/h. Effective neutron fluxes of from 1.5 to 1250 mrem/h are available, depending upon the type of instrument being calibrated. Details of the construction and calibration of the facility and the methods used for calibration of radiation survey instruments are given. Author (NSA)

# 23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

**N69-37280*#** California Univ., La Jolla. Dept. of Applied Physics and Information Science.
**THE MODAL DECOMPOSITION OF APERTURE FIELDS IN DETECTION AND ESTIMATION OF INCOHERENT OBJECTS**
Carl W. Helstrom 1969 36 p refs
(Grant NGR-05-009-079)
(NASA-CR-105799) Avail: CFSTI CSCL 20F

A decomposition of the field at the aperture of an optical system in terms of the eigenfunctions of a certain integral equation is useful in analyzing the detectability of incoherent objects. The kernel of the integral equation is the mutual coherance function of the light from the object. The decomposition permits specification of the number of degrees of freedom in the aperture field contributing to detection of the object. Quantum-mechanically the coefficients of the modal decomposition become operators similar to the usual creation and annihilation operators for field modes. The optimum detector of the object is derived in terms of these operators. Specific detection probabilities are calculated for a uniform, circular object whose light is observed at a circular aperture. The modal decomposition is also applied to estimating the radiance distribution of the object plane. Author

**N69-37352*#** National Aeronautics and Space Administration, Washington, D.C.
**TREATISE ON POLARIMETRY [TRAITE DE POLARIMETRIE]**
G. Bruhat Sep. 1969 617 p refs Transl. into ENGLISH from Rev. d'Optique Theorique et Instrumentale (Paris), 1930 p 1-447
(NASA-TT-F-12630) Avail: CFSTI CSCL 20F

A systematic, illustrated discourse on the apparatus developed for polarimetric measurements is set forth and the underlying measured phenomena, particularly the phenomena of rotary polarization of the isotropic substances is reviewed. General principles of light polarization, interpretation through light vibration theory, polarizing prisms, determining the orientation of a rectilinear vibration, and the apparatus for rotation measurement, rotatory dispersion measurements, and circular dichroism measurements are presented analytically for knowledge of instrument requirements and precision of measurements. Construction details, standardization and control, and appropriate calculations for each instrument accompany the drawings of the basic instrument scheme. A freshly designed instrument directed to the case of ellipticity due to circular dichroism is offered for measuring colored substances. Literature references numbering 882 include the studies of Erasmus and Huygens and consist of the major experimental studies up to 1930. M.H.E.

**N69-37420#** British Columbia Univ., Vancouver. Dept. of Physics.
**THEORETICAL ASPECTS OF MAGNETIC FLUCTUATIONS**
Ronald E. Burgess [1969] 18 p refs Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969
Avail: CFSTI

The thermodynamic treatment of equilibrium fluctuations in magnetic systems is discussed and applied to a variety of situations. The spectral density of the magnetic moment or flux are derived for simply-connected bodies (sphere and cylinder) and for multiply-connected systems (loop and hollow cylinder). The material is considered to be either a normal conductor, a superconductor or ferromagnetic. The results are valid in the presence of a static magnetic field and also if the susceptibility is field-dependent. No abrupt change in fluctuations occurs as a superconductor is taken through the transition temperature. The introduction of a Josephson junction or a resistive link in a superconducting loop is shown to increase the flux fluctuations markedly with a steady increase as the link is made weaker. At high frequencies the fluctuation spectrum for a superconductor approaches that for the same system in the normal state. Author (ESRO)

**N69-37443#** California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.
**WEAKLY-COUPLED SUPERCONDUCTORS WITH NORMAL METAL BARRIERS**
John Clarke [1969] 7 p Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969
Avail: CFSTI

Junctions consisting of a thin film of copper between two

films of lead behave as Josephson junctions. The junctions will sustain a supercurrent up to a certain critical value above which a voltage appears. The effect of a magnetic field upon the critical current has demonstrated that the junctions are Josephson-like in their behavior. The critical current rises rapidly as the temperature is lowered and decreases exponentially with increasing thickness of copper. These junctions may be fabricated with good reliability and thermally cycled between helium and room temperatures without significant deterioration. Their low resistance, less than $10^{-6}$ ohms, implies a very low noise across the junction, a result which may make their ultimate resolution in magnetometry extremely high. Author (ESRO)

**N69-37445#** Texas Instruments, Inc., Dallas.
**ADVANCES IN OPTICALLY PUMPED $He^4$ MAGNETOMETERS: RESONANCE AND NONRESONANCE EFFECTS**
Robert E. Slocum [1969] 18 p Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20–23 May 1969
Avail: CFSTI

Optically pumped samples of $2^3S_1$ $He^4$ are utilized as detecting elements in two types of magnetometers which can be characterized by thin field detecting methods as either resonance or nonresonance devices. The resonance designation is applied to the various magnetic resonance techniques which employ optical detection. The nonresonance technique utilizes the orientation dependence of pumping beam absorption in an optically pumped gas to derive vector field information. A description is given of recent investigations of the orientation dependence of the resonance signal in optically pumped helium. ESRO

**N69-37452#** Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin (Italy).
**BARKHAUSEN NOISE IN FERROMAGNETIC MATERIALS [LE BRUIT DE BARKHAUSEN DANS LES MATERIAUX FERROMAGNETIQUES]**
G. Montalenti [1969] 8 p In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20–23 May 1969 Sponsored by Consiglio Nazl. delle Ric.
Avail: CFSTI

The background noise caused by the Barkhausen effect is analyzed using the power spectra theory. Several distribution functions for the pulses are discussed. Results compatible with experimental data are obtained for magnetization frequencies smaller than 1 Hz but for higher frequencies no reliable results have been gained. ESRO

**N69-37600#** Laboratoire d'Electrostatique et de Physique du Métal, Grenoble (France). Section Physique des Couches Minces.
**POSSIBLE APPLICATIONS OF MAGNETIC THIN FILMS FOR THE DETECTION OF WEAK MAGNETIC FIELDS [POSSIBILITES D'APPLICATION DES COUCHES MINCES MAGNETIQUES A LA DETECTION DES CHAMPS MAGNETIQUES FAIBLES]**
B. F. Waksmann [1969] 8 p refs In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20–23 May 1969 Sponsored by CNES and CNRS
Avail: CFSTI

Some ferromagnetic thin films have been prepared by vacuum evaporation in the presence of a magnetic field so that the film shows an axial anisotropy on which magnetization is easy and presents a rectangular hysteresis cycle whereas in the transverse direction the magnetization is linear. It is shown how these films can be used to measure small magnetic fields. The limits of the method are discussed and subjects for further research work presented. ESRO

**N69-37618#** Ecole Normale Supérieure, Paris (France). Lab. de Spectroscopie Hertzienne.
**ON SOME RESONANCES OF LEVEL CROSSING OF ATOMS OPTICALLY PUMPED IN A ZERO MAGNETIC FIELD. PART 1: THEORY. [DIVERSES RESONANCES DE CROISEMENT DE NIVEAUX SUR DES ATOMES POMPES OPTIQUEMENT EN CHAMP NUL. PREMIERE PARTIE: THEORIE]**
C. Cohen-Tannoudji, J. Dupont-Roc, and S. Haroche [1969] 15 p refs In FRENCH Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20–23 May 1969
Avail: CFSTI

The light absorbed or scattered by an atom varies in a resonant way where the static magnetic field is swept around the crossing of two different Zeemann sublevels of this atom. Resonances of a same kind but finer are observed at the crossing of two different sublevels in the ground state of atoms optically pumped, in particular where the magnetic field is zero. A theory of these resonances is presented and their characteristics analyzed. Another similar type of resonance is also studied which appears when an atomic gas is transversally pumped in an amplitude modulated magnetic field. ESRO

**N69-37625#** Naval Ordnance Lab., White Oak, Md.
**THE REACTION OF A RIGID BODY TO A UNIFORM FORCE FIELD**
Milton H. Lackey (M.S. Thesis — Md. Univ., College Park) 17 Mar. 1969 68 p refs
(AD-688111; NOLTR-68-60) Avail: CFSTI CSCL 20/3

The paper describes a method for determining the forces of reaction of a stationary, rigid body to a uniform, external, force field. The forces produces rotation. The results of the paper are applicable to general Newtonian force fields including electromagnetic and gravitational fields. Typically, the method can be used to determine the torque on a satellite from the earths magnetic field. Author (TAB)

**N69-37635** National Lending Library for Science and Technology, Boston Spa (England)
**A STABLE OPTIMIZED SUPER-CONDUCTING MAGNET SYSTEM [STABILNAYA OPTIMIZIROBANNAYA SVERKHPROVODYASHCHAYA MAGNITNAYA SISTEMA).**
V. N. Agureev et al Jun. 1969 20 p refs Transl. into ENGLISH from Russian report
(NLL-RTS-50611) Avail: Natl. Lending Library, Boston Spa, Engl.: 40s

A superconducting magnet system for producing a magnetic field of about 50 k Oe in a 200 mm dia. aperture is described. The system has an overall weight of 260 kg and consists of two solenoids sectionalized in both the axial and radial directions, with provision for varying the distance between them. The coil is made of stabilized copper bar into which strands of the alloy Nb-50%Zr are inserted. To reduce the overall weight and cost of the superconductor, the coil was made self-consistent not only with respect to the critical current but also with respect to the stabilization parameters (the number of strands in the conducting bar was varied from 20 to 4 and its cross section from 6.5 $mm^2$ to 4 $mm^2$). The calculation was carried out on an E Ts V M M-20 computer. Author

**N69-37674#** California Inst. of Tech., Pasadena.
**SUPERCONDUCTING MAGNETOMETERS**
J. E. Mercereau [1969] 34 p refs Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20–23 May 1969
Avail: CFSTI

Superconductivity at finite voltages which can be characterized as the resistive superconducting state is discussed. A two-fluid description for superconductivity is assumed and a model is constructed which gives rise to a possible mechanism. It is shown that the normal and supercurrents enter only in an additive way with no interference effects. Application of the method is made to thin film superconducting rings and the noise problem due to the superconducting ring carrying normal current in addition to

supercurrent for the time interval of the transistor is analyzed. A magnetometer based on superconducting circuits is described. ESRO

N69-37575# Leiden Univ. (Netherlands). Kamerlingh Onnes Laboratorium.
**SUPERCONDUCTING POINT CONTACTS WEAKLY CONNECTING TWO SUPERCONDUCTORS**
R. de Bruyn Ouboter and A. Th. A. M. de Waele [1969] 18 p refs Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969
Avail: CFSTI

A review of dc and ac interference phenomena in superconducting point contacts weakly connecting two superconductors is presented. The properties of a single point contact is discussed. At first both the supercurrent and the normal current through the contact are taken into account but the self-inductance of the point contact and the capacitive coupling between the superconductors are ignored. However, certain limitations to the differential equations of the contact are applied. Primarily, the two cases for which either the current or the voltage are constants of time are discussed. Then, the external magnetic field dependence of the critical current through a double point contact is discussed, the self induced flux on the enclosed area being taken into account. Application is made to detection of very weak magnetic fields. Finally the properties of double point contacts in the resistive-superconductive region, in relation with both the ac and dc Josephson effects are discussed. ESRO

N69-37611# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
***AN* ANALYSIS OF THE BRAYTON CYCLE AS A CRYOGENIC REFRIGERATOR**
R. C. Muhlenhaupt and T. R. Strobridge Aug. 1968 117 p refs
(NBS-TN-366) Avail: SOD $1.25

The performance of a Brayton-cycle refrigerator has been computed taking into account the efficiencies of the various components. The results are presented in graphical form. These charts give the input power requirements, mass flow rate, pertinent temperatures, and allow selection of the optimum high pressure for a given set of component characteristics. Author

N69-37709# Bureau of Mines, College Park, Md. Metallurgy Research Center.
**MAGNETIC SEPARATION OF MINERALS OF LOW SUSCEPTIBILITY AND SMALL PARTICLE SIZE**
Foster Fraas Sep. 1969 18 p refs
(BM-RI-7292) Avail: Issuing Activity

A description is given of a method for separating minerals at magnetic susceptibilities within the diagmagnetic susceptibility range. The maximum feed rate varies directly with the square root of the lower limit of permissible susceptibility, while the lower limit of permissible susceptibility varies inversely as the square of the magnetic field strength. Minerals may be separated at particle sizes smaller than possible on conventional dry type magnetic separators. Author

N69-37809# Navy Underwater Sound Lab., New London, Conn.
**THE PROPAGATION OF SOUND IN IMPERFECT OCEAN SURFACE DUCTS**
Morris Schulkin 22 Apr. 1969 137 p refs
(AD-688444; USL-1013) Avail: CFSTI CSCL 8/3

In the report, the author attempts to organize a field of knowledge. He reviews the field of the imperfect ocean surface sound duct and makes original contributions of detail where he believes that the greatest and most important needs exist. One of these contributions is the introduction of the concept of statistical reciprocity to explain the observed depth dependence of acoustic intensity within the duct at the higher frequencies. An expression is obtained for surface-coupled attenuation for acoustic propagation in surface ducts, and it is shown that bubble layers, established by wind and breaking waves, can be important in causing absorption losses. The author uses these facts, together with a model of strong acoustic scattering depending on the mean-square slope of the surface irregularities, to account for the acoustic intensity in the shadow zone below the surface duct. The importance of the mean-square slope parameter is also demonstrated by its use to account for wind-speed and acoustic frequency effects observed in acoustic backscattering measurements, especially in the presence of a surface duct. In addition, the author evaluates the importance of wavy thermoclines, drift currents, and the biomass in relation to surface duct propagation. Author (TAB)

N69-37863# North Carolina State Univ., Raleigh. Center for Acoustical Studies.
**A FORTRAN PROGRAM FOR CALCULATING THE EQUIVALENT SOURCE STRENGTH FOR THE CLASS 1 AND 2 FLEXTENSIONAL UNDERWATER ACOUSTIC TRANSDUCER DESIGNS Technical Report, 1968 - 1969**
Jack N. Boone and Larry H. Royster Apr. 1969 27 p refs
(Contract NONR-486(11))
(AD-689549; TR3; CAS-38) Avail: CFSTI CSCL 20/1

A Fortran program is presented which computes a normalized equivalent source strength for the Class I and approximates the Class II Flextensional Underwater Acoustic Transducer Shells. The program utilization, the input data and the output data formats are described in detail. Author (TAB)

N69-37874# Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
**PROPAGATION OF VERY LOW-FREQUENCY cw SOUND SIGNALS IN THE DEEP OCEAN**
J. Shaffer, D. Nutile, and A. N. Guthrie Apr. 1969 41 p refs
(Contract Nonr-266(84))
(AD-689744; TR-172; CU-200-69-ONR-266-Phys) Avail: CFSTI CSCL 20/1

A comparison has been made between measured transmission loss for 13-1/3 Hz cw sound signals propagated at long range over the Hatteras Abyssal Plain and transmission loss computed by use of the Hudson Laboratories Ray Tracing Program. Good agreement was obtained out to a range of 600 km beyond which the experimental data became unreliable because of low signal-to-noise ratio. Pressure amplitude versus range curves for two 13-1/3 Hz cw transmission runs made in opposite directions over the same track in the Hatteras Abyssal Plain have been compared. The runs covered a range interval between 40 km and 340 km, and five days elapsed between the start and finish of the runs. Good agreement was observed, at least in major features of the sound field, between the two runs. Author (TAB)

N69-37884*# National Aeronautics and Space Administration, Washington, D.C.
**ON AN INTERMEDIATE DISCREPANCY IN THE ELECTRODYNAMIC AND RELATIVISTIC THEORY OF ELECTROMAGNETIC MASS [UBER EINEN WIDERSPRUCH ZWISCHEN DER ELEKTRDYNAMISCHEN UND DER RELATIVISTISCHEN THEORIE DER ELEK ROMAGNETISCHEN MASSE]**
E. Fermi Sep. 1969 10 p refs Transl. into ENGLISH from Physik. Z. (Ger.), v. 23, 1922 p 340-344
(NASA-TT-F-12554) Avail: CFSTI CSCL 20C

A difference in electromagnetic mass calculated for a spherical distribution of electricity from electrostatic energy and from relativistic energy system considerations is shown to result from the fact that in the usual electrodynamic theory of electromagnetic mass a relativisically unreliable concept of the rigid body is used, even if not explicitly. Conversely, the relativistically most natural and most justifiable concept of the rigid body leads to the value for the electromagnetic mass. Author

N69-37957 Joint Publications Research Service, Washington, D.C.

**DIFFRACTION OF A CYLINDRICAL HYDROACOUSTICAL WAVE AT THE JUNCTION OF TWO SEMI-INFINITE PLATES**

D. P. Kouzov 12 Sep. 1969 17 p refs Transl. into ENGLISH from Prikl. Mat. i Mekhan. (Moscow), v. 33, no. 2, 1969 p 240-250 (JPRS-48800) Avail: CFSTI

A two-dimensional steady-state diffraction problem is examined. A liquid medium fills the lower half-plane, and acoustical processes are excited in it by a point-type source located at a certain depth. The surface of the liquid is covered with two joining semi-infinite plates. Mechanical properties of both plates are considered to be dissimilar. An exact mathematical solution of the problem is constructed for the case when the conditions at the junction of the plates are not fixed. This solution contains a certain number of arbitrary constants. A method of finding these constants is shown for specified conditions at the junction of the plates. The specific character of the latter problem consists in that a formal application of boundary-contact operators to the general solution engenders divergent integrals of the expressions with an algebraic growth at the infinity. Examinations are carried out in certain abstract terms. Expressions for boundary and boundary-contact operators are not concretized. Therefore, the results remain valid with different approximations of the plate theory used. Author

N69-38025# Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.

**SEAMOUNT DETECTION BY CROSS CORRELATION OF REVERBERATION ECHOES**

Wilton A. Hardy Mar. 1969 64 p refs

(Nonr-266(84))

(AD-689742; TR-169; CU-197-69-ONR-266-Phys) Avail: CFSTI CSCL 8/10

A 300-lb TNT explosive charge was used as an acoustic source to excite underwater reverberation in several ocean areas. The echoes returned from ranges of more than 40 miles from the source were primarily due to reflections from prominent slopes of the bathymetry of well-defined seamounts. The signals were analyzed by cross correlation across the members of several shipboard-suspended hydrophone pairs to determine the relative time delays of the signals and hence the azimuthal orientation of the echo arrivals with respect to the hydrophones. The ranges of the echoes were determined from the round-trip travel time of the acoustic signals from the source back to the detecting hydrophones. The results, presented in this paper, show that prominent bathymetric reflectors can be located in the insonified ocean region at ranges up to, and sometimes more than, 300 miles from the source. Author (TAB)

N69-38036# Centre National de la Recherche Scientifique, Bellevue (France). Laboratoire des Haute Pressions.

**MEASUREMENT OF THE VISCOSITY COEFFICIENT OF HIGH PRESSURE NITROGEN [MESURE DU COEFFICIENT DE VISCOSITE DE L'AZOTE A HAUTE PRESSION]**

Jean Vermesse (Ph.D. Thesis--Paris Univ.) 1969 224 p refs In FRENCH

Avail: CFSTI

Different types of viscometers are discussed, especially those which operate at pressures over 100 bars. The experimental facility used to measure the viscosity of nitrogen at pressures up to 400 bars is described, experimental results are presented and the accuracy of measurements discussed. The distribution function of molecules and the Liouville equations are then used for evaluating the dynamic viscosity of high density gases. The experimental results are then compared with theoretical predictions. ESRO

N69-38068# Stanford Research Inst., Menlo Park, Calif.

**PSYCHOLOGICAL EXPERIMENTS ON SONIC BOOMS CONDUCTED AT EDWARDS AIR FORCE BASE Final Report**

K. A. Kryter, P. J. Johnson, and J. R. Young Aug. 1968 119 p refs

(Contract AF 49(638)-1758)

(AD-689844) Avail: CFSTI CSCL 20/1

A series of tests were conducted in June 1966 and October 1966 to January 1967 in which human subjects (located indoors and outdoors), and special test structures were exposed to booms from F-104, F-106, B-58, SR-71, and XB-70 supersonic aircraft, and the noise from KC-135 and WC-135B subsonic aircraft. Physical measurements were made of the sonic boom signatures, subsonic aircraft noise, and the response of structures to the booms and noise. Psychological measurements were made of the subjective acceptability to several hundred subjects of the booms and subsonic aircraft noise. Details of the test plan and procedures, and the results of the data analyzed are presented. Author (TAB)

N69-38101# Riverside Research Inst., New York.

**POWER SPECTRAL MEASUREMENTS BY THE DIFFRACTION OF COHERENT LIGHT**

H. Stark Oct. 1968 225 p refs

(Contract F19628-68-C-0084; ARPA Order 1088)

(AD-689818; RRI-T-1/006-1-00) Avail: CFSTI CSCL 20/6

The theory and technique of estimating power spectral densities by Fraunhofer diffraction are investigated analytically and experimentally. A technique for estimating the spectral density is developed by which the estimate is independent of changing light levels in the diffraction system. It is shown that the estimated spectrum is biased and in the case of a rectangular aperture, the error can be written in terms of the Hilbert transforms of the spectrum. The variability of the estimate is computed and the ratio of the variance to square mean is shown to approach unity for large apertures, indicating the need for smoothing by additional filtering. Reasonable bounds on the bandwidth of the scanning filter are established theoretically. The experimental results are found consistent with the theoretical evaluations. Techniques for reducing the zero-order light level are investigated. The spectral densities of several common photographic films are experimentally determined and compared with models of grain-noise and total film-noise. Author (TAB)

N69-38105# Army Materials and Mechanics Research Center, Watertown, Mass.

**A REPORT GUIDE TO ULTRASONIC TESTING LITERATURE, VOLUME 6**

Frederick G. Stenton and Charles P. Merhib Apr. 1969 155 p

(AD-689455; AMMRC-MS-69-03) Avail: CFSTI CSCL 13/8

The main objective of the compilation is to provide a simple and fast access to information on the subject of ultrasonic testing and also to provide sufficient information in the form of abstracts and word descriptors to make the listing useful. Author (TAB)

N69-38109# Lockheed Missiles and Space Co., Palo Alto, Calif.

**RADIATION TRANSFER IN A PLANE LAYER TAKING ACCOUNT OF NONLINEARITY IN ABSORPTION AND SCATTERING**

E. P. Zege [1969] 10 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 10, no. 6, 1969 p 940-947

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method for the approximate determination of integral characteristics of scattered radiation is described for a plane geometry. It applies to any kind of dependence of the scattering and absorption properties on the radiation density. Author

N69-38131# Aerospace Corp., El Segundo, Calif. Lab. Operations.

**WAVEFRONT RECONSTRUCTION AND ITS APPLICATION**

**TO THE STUDY OF THE OPTICAL PROPERTIES OF ATMOSPHERIC AEROSOLS**
George C. Sherman 31 Jul. 1969 116 p refs
(ATR-69(8103)-1) Avail: CFSTI

A theory is developed for optical wavefront reconstruction in a manner appropriate for the application of holography to the study of the optical properties of atmospheric aerosols. The new holography theory is developed under appropriate simplifying assumptions by applying Rayleigh's integral formula and the angular spectrum of plane waves to treat relevant diffraction problems. The attenuation of the inhomogeneous waves causes a loss of resolution that is especially important in the images of aerosol particles of dimensions smaller than the wavelength. Under idealized conditions, a perfect, three-dimensional, real image of a wave field is obtained from the hologram only if the wave field belongs to a special class of wave fields herein called source-free wave fields. Source-free wave fields are shown to be of fundamental importance in the fields of imaging and diffraction by planar screens, and several of their unique properties are established. Author

**N69-38141*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**RELATIVISTIC PHYSICS OF CLOCKS AND THE SYNCHRONOUS ORBIT CLOCK EXPERIMENT**
Nat Edmondson, Jr. and Fred D. Wills 1 Jun. 1969 75 p refs
(NASA-TM-X-53802) Avail: CFSTI CSCL 20J

The basic principles of special relativity and inertial reference frames are discussed. The Lorentz transformation is given and expressions for the proper time in an inertial frame of reference are developed. A concept of the space–time metric is developed from the properties of noninertial systems. Expressions for differential distance and time intervals are developed from the space–time metric. Some of the basic properties of curvilinear coordinates, tensors, and covariant differentiation are expounded. Elementary properties of the Riemann curvature tensor and the development of the empty space gravitational field equations are presented. Comments are made about the gravitational field equations and some consequential space–time metrics. The combined effects of uniform rotation and the gravitational field on the space–time metric, and hence proper time, are discussed and developed. Finally, expressions are developed which measure the gravitational and relative motion effects on frequency comparisons between two identical atomic oscillators, one earth fixed and the other in synchronous orbit above the earth-fixed oscillator. The first order Doppler effect is theoretically eliminated from the comparison. Author

**N69-38161#** Houston Univ., Tex. Dept. of Mechanical Engineering.
**NOTE ON THE ANALYSIS OF TWO DIMENSIONAL MOTION RESISTED BY COULOMB FRICTION**
M. L. Chu and D. Muster May 1969 31 p refs
(Contract Nonr-4492(01))
(AD-689553; TR-16) Avail: CFSTI CSCL 20/11

The effect of Coulomb friction on two-dimensional motions are studied experimentally in order to corroborate the theoretical analysis. In this report, a test arrangement designed to simulate different combinations of two-dimensional motions with Coulomb friction is described. The results of a series of tests are discussed; the tests include various combinations of motions, namely, a uniform velocity combined with oscillatory motions and two oscillatory motions whose lines of action are parallel, normal and at an angle between. In each case, the parameters which characterize the motion were measured (that is, friction force, velocity, etc.) The average power is determined from these data by a semigraphical method and compared with computed theoretical values. Author (TAB)

**N69-38180*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**PRESSURE EFFECT OF A SOUND WAVE ON A CRYOGENIC FLUID**
Fritz Kramer Washington Jul. 1967 23 p refs
(NASA-TN-D-4024) Avail: CFSTI CSCL 20A

It has been observed that a sound wave incident upon the surface of a liquid in an open container can produce a positive pressure differential between the liquid and the ambient atmosphere. This pressure is noticeable only when the liquid is close to its boiling point. The proposal has been made to utilize such a pressure differential for keeping a cryogenic propellant settled at the bottom of its tank during gravity-free flight in space. The report shows that this pressure can be explained as an effect of cavitation of the liquid during the negative half-cycle of the acoustic pressure wave. Author

**N69-38222*#** National Aeronautics and Space Administration, Washington, D.C.
**NOTES ON THE ESSAY: MAGNETIC PERMEABILITY OF AN ARTIFICIAL MAGNETIC MEDIUM BY ALEXANDER GOLDHAMMER [BEMERKUNG ZU DEM AUFSATZ: MAGNETISCHE PERMEABILITAT EINES KUNSTLICHEN MAGNETISCHEN MEDIUMS VON ALEX. GOLDHAMMER]**
H. Maurer Sep. 1969 3 p Transl. into ENGLISH from Physik. Z. (West Ger.), v. 23, 1922 p 346–347
(NASA-TT-F-12672) Avail: CFSTI CSCL 20C

The permeability $\mu$ of a body which is made up of steel balls with intermediate layers of ebonite in a glass tube is experimentally determined and tested to see how it agrees with the value calculated from the Poisson formula. Author

**N69-38223*#** California Univ., La Jolla. Dept. of Applied Physics and Information Science.
**THE APPLICATION OF SIGNAL DETECTION THEORY TO OPTICS Progress Report, Period Ending 15 Sep. 1969**
Carl W. Helstrom 15 Sep. 1969 78 p refs
(Grant NGR-05-009-079)
(NASA-CR-105975) Avail: CFSTI CSCL 20F

Research undertaken is outlined. Topics included are the use of a modal decomposition of the aperture field in the detection of incoherently radiating objects and the mapping of the radiance function of the object plane, mean-square errors in the estimation of radiance at sample points of the object plane, and the properties of filters and predictors involving the discrete Fourier transform. Author

**N69-38226*#** Techtran Corp., Glen Burnie, Md.
**FOCALIZATION IN SHORT NON-LINEAR WAVES: APPLICATION TO BALLISTIC NOISE OF FOCALIZATION**
J. P. Guiraud Washington NASA Sep. 1969 23 p refs Transl. into ENGLISH from French Paper Presented at AGARD Propulsion Energetic Panel Meeting, St. Louis, France
(Contract NASw-1695)
(NASA-TT-F-12442) Avail: CFSTI CSCL 20A

The sonic boom is studied. The propagation phenomenon is described mathematically, and the accumulation of perturbation along the wave surface is analyzed. Particular attention is given to the phenomenon of focalization in the light of short wave theory. Author

**N69-38244#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**ON THE STRUCTURE OF WEAK SHOCKS IN RELAXING MEDIA**
G. M. Arutiunian [1969] 10 p refs Transl. into ENGLISH from Prild. Mekh. i Tekhn. Fiz. (USSR), no. 2, 1969 p 110–115
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The structure of weak shocks in media where temperature relaxation occurs is treated, assuming that the state of the material in the transition layer changes slowly relative to equilibrium buildup. Two component mixtures, such as the emulsion of one liquid in another or a gas containing solid suspended particles, are considered.

as relaxing media. Upon compression of the material in the shock, a temperature difference occurs between the components of such a medium; this also attenuates the relaxation process of heat exchange. Expressions are derived for analyzing the phenomena in which the scale of the inhomogeneity of the medium is small as compared with the width of the shock transition layer. A.C.R.

N69-38283# Miami Univ., Coral Gables, Fla. Dept. of Physics.
**FORCE-FREE HYDROMAGNETIC DYNAMIC STABILITY**
Joseph Norwood, Jr., and Daniel R. Wells [1969] 18 p refs
(MIAPH-AP-68.8) Avail: CFSTI

The stability of force-free hydromagnetic equilibria is reviewed, and a dynamic solution for force-free fields is derived. It is shown that such a solution is stable if the mass flow is collinear Alfvénic (equipartition). This combination is shown to be the lowest-energy solution of the nonlinear hydromagnetic equations that possesses both finite velocity and magnetic field. The ratio of current density to magnetic flux density is derived on the basis of a general relation for rotation of hydromagnetic fluids with finite Hall effects. Author (NSA)

N69-38298# Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.
**INVESTIGATION OF THE ACOUSTIC PROPERTIES OF AIR BUBBLES IN WATER Final Report**
Earl M. Uram, Joel W. Hollenberg, and Richard P. Bernicker Feb. 1969 26 p refs
(Contract Nonr-263(61))
(AD-689555; R-1371) Avail: CFSTI CSCL 20/1

An experimental facility and related techniques are described, and data are presented which were obtained in a study of sound generated by a single gas bubble excited when passing through a pressure field generated by the geometry of the duct. The sound was detected by a newly developed annular hydrophone, and amplified and recorded on strip chart by means of a high-frequency galvanometer. The resonant frequency of the excited bubble is found to be practically independent of the duct flow rate, and the frequency dependence on bubble radius is found to be adequately predicted by a theory advanced by Devin. Data obtained in a similar experiment by one of the authors is included, and the over-all range of bubble radius for the combined experiments is 0.016 in. to 0.075 in., with a mean flow-velocity range of 0.441 ft/sec to 2 ft/sec. Author (TAB)

N69-38306# Brookhaven National Lab., Upton, N.Y.
**FLICKER NOISE IN PHYSICAL MEASUREMENTS**
Veljko Radeka [1969] 28 p refs Presented at the Intern. Nucl. Electronics Symp., Stresa, Italy Sponsored by AEC
(BNL-13591; CONF-690515-1) Avail: CFSTI

Low frequency divergent noises with spectral density $|f|^{\alpha}$ where $\alpha \leq 1$, and their effect on physical measurements, with special reference to $1/|f|$ noise was examined. In an attempt to present a picture of this noise with regard to the measurements of observable physical quantities, the questions about generation of noise, its divergence, correlation properties and measurements of variance are discussed. A statistical model for generation of low frequency divergent noises is used to consider the divergence problem in both the frequency and time domain. It is shown that $1/|f|$ noise is "weakly divergent," and that power limitation presents no reason to impose a low frequency limit within time intervals observable in nature. Correlation properties are discussed in terms of the time-dependent correlation function, using an ideal impulse response which generates low frequency noise from white noise. Two general models for generation of $1/|f|$ noise are summarized and discussed. Author (NSA)

N69-38374# Princeton Univ., N.J. Plasma Physics Lab.
**STABILITY OF RIGID CURRENT LOOPS IN AN AXISYMMETRIC FIELD**
F. H. Tenney Jan. 1969 40 p refs
(Contract AT(30-1)-1238)
(MATT-693) Avail: CFSTI

The equations of motion for a superconducting levitated ring in an axisymmetric magnetic field are developed. Stability criteria are presented and discussed. Stable equilibria for the ring in certain static magnetic field configurations are demonstrated. Author (NSA)

N69-38391# California Univ., Berkeley.
**THEORIES AND EXPERIMENTS ON NONLINEAR OPTICS Final Report, 1 Jun. 1965 - 31 May 1969**
Y. R. Shen 30 Jun. 1969 84 p refs
(Contract Nonr-3656(32); ARPA Order-306)
(AD-690207) Avail: CFSTI CSCL 20/6

Experimental results of self-focusing and self-trapping of laser light in liquids and on tunable far-infrared difference-frequency generation are presented. Theoretical investigation on various problems on nonlinear optics is described. Author (TAB)

N69-38466# Oak Ridge National Lab., Tenn. Solid State Div.
**BIBLIOGRAPHY OF MAGNETIC MATERIALS AND TABULATION OF MAGNETIC TRANSITION TEMPERATURES**
T. F. Connolly, comp. and Emily D. Copenhaver, comp. May 1969 78 p refs Revised
(Contract W-7405-ENG-26)
(ORNL-RMIC-7-Rev) Avail: CFSTI

This revision includes about 1,000 additional measurements of Curie and Néel points of magnetic materials. A total of 1,224 references is presented. An alphabetical list of the materials by chemical formula is presented in two parts: ferromagnetic (or ferrimagnetic) and antiferromagnetic (or metamagnetic). NSA

N69-38488# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
**ON SOME QUESTION CONCERNING THE KINETICS OF A MODEL SYSTEM ALLOWING THE EXACT SOLUTIONS**
I. A. Kvasnikov and A. V. Shalaev 1969 22 p refs In RUSSIAN; ENGLISH summary
(ITF-69-12) Avail: AEC Depository Libraries

A quantum statistical model allowing exact solution is applied to study relaxation processes in systems. Two essentially different types of relaxation are established: a comparatively rapid relaxation connected with the chectiestion time, after which the system can be described in a rough kinetic time scale by Pauli kinetic equations; and relaxation to an equilibrium state described by the above equations. Author (NSA)

# 24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N69-37224# Idaho Nuclear Corp., Idaho Falls. Nuclear and Chemical Technology Div.
**NUCLEAR TECHNOLOGY BRANCH Yearly Progress Report, Period Ending 30 Jun. 1969**
R. L. Heath, ed. Dec. 1968 357 p refs
(Contract AT(10-1)-1230)
(IN-1218; TID-4500) Avail: CFSTI

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1. NEUTRON INTERACTIONS WITH NUCLEI p 1-58

refs (See N69-37227 22-24)

2. NEUTRON INTERACTIONS WITH ATOMS p 57–72 refs (See N69-37228 22-24)

3. NUCLEAR PROPERTIES p 73–139 refs (See N69-37229 22-24)

4. MATERIALS p 141–179 refs (See N69-37230 22-26)

5. EXPERIMENTAL FACILITIES, TECHNIQUES, AND INSTRUMENTATION p 181–316 refs (See N69-37231 22-22)

**N69-37227#** Idaho Nuclear Corp., Idaho Falls. Nuclear and Chemical Technology Div.

**NEUTRON INTERACTIONS WITH NUCLEI**

*In its* Nucl. Technol. Branch Dec. 1968 p 1–56 refs (See N69-37226 22-24)

Avail: CFSTI

Experimental neutron cross section data are reported from neutron interactions with numerous nuclei. These data concern the total cross sections, elastic and resonance distributions, and comparisons of measured and calculated values. NSA

**N69-37228#** Idaho Nuclear Corp., Idaho Falls. Nuclear and Chemical Technology Div.

**NEUTRON INTERACTIONS WITH ATOMS**

*In its* Nucl. Technol. Branch Dec. 1968 p 57–72 refs (See N69-37226 22-24)

Avail: CFSTI

Discussed are neutron absorption cross section effects on reactivity of boric acid solutions, temperature and chemical binding effects on neutron scattering and absorption, and neutron pulse widths for monitoring reactor moderators. NSA

**N69-37229#** Idaho Nuclear Corp., Idaho Falls. Nuclear and Chemical Technology Div.

**NUCLEAR PROPERTIES**

*In its* Nucl. Technol. Branch Dec. 1968 p 73–139 refs (See N69-37226 22-24)

Avail: CFSTI

Nuclear level structures, rotational and decay states, as well as vibration and resonance bands are studied on a variety of isotopes. The survey covers mostly rare earth radioactive isotopes but also includes some nuclear properties of isotopic chlorine, iron, and tantalum. NSA

**N69-37232#** National Standard Reference Data System.

**PHOTON CROSS SECTIONS, ATTENUATION COEFFICIENTS, AND ENERGY ABSORPTION COEFFICIENTS FROM 10 keV TO 100 GeV**

J. H. Hubbell Aug. 1969 83 p refs

(NSRDS-NBS-29) Avail: SOD $0.75

Previous tabulations are updated and extended. Included are: (1) a tabulation of the attenuation coefficient for 23 elements ($_1$H to $_{92}$U) between 10 keV and 100 GeV; and (2) a tabulation of the energy absorption coefficient for air, water, and 18 elements between 10 keV and 10 MeV, as well as for air, water, and 7 elements up to 100 MeV. Detailed information is also included on the predominant processes (photoelectric absorption, Compton scattering, and pair production) and other processes which combine to give the attenuation coefficient. Theoretical and experimental data are reviewed, and auxiliary tables and approximation formulas are given. Finally, tabulations of cross sections for the predominant processes between 10 keV and 100 GeV for 23 elements and for 13 compounds and mixtures are presented. Author

**N69-37330#** Utrecht State Univ. (Netherlands). Physics Lab.

**DISCUSSION OF THE SECOND DERIVATIVE OF THE PROBE CURVE MEASURED WITH A SPHERICAL LANGMUIR PROBE IN A DISCHARGE IN HELIUM**

J. Van Eck. *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 8 p refs (See N69-37326 22-25)

Avail: AEC Depository Libraries

Druyvesteyn's method is used to obtain the energy distribution of electrons in a weakly ionized gas from the second derivative (SD) of the current–voltage curve of a probe. The measurements were performed with a spherical probe in the positive column of a helium discharge. The influence on the SD of the voltage on the guard sleeve, surrounding the quartz-screened probe wire, was measured. A thrustworthy SD curve was found when the guard sleeve was held at space potential. The SD curve, measured in this way, showed an extra increase near space potential over about 1.5 V, which is ascribed to the SD of the ion attraction curve. If one subtracts this contribution it is possible to compare the true SD curve of electrons with calculated energy distribution functions. Author (NSA)

**N69-37336#** Technische Hogeschool, Eindhoven (Netherlands).

**THE ELECTRON ENERGY DISTRIBUTION AND THE ELECTRON DENSITY IN MOVING STRIATIONS**

J. G. A. Hoelscher. *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 12 p refs (See N69-37326 22-25)

Avail: AEC Depository Libraries

Langmuir-probe characteristics are measured in eleven different phases of a simple moving striation. From these characteristics the electron energy distribution is determined numerically. The densities of the electrons are calculated by integrating the energy distribution functions. These densities are measured also by the phase shift of a 3-cm electromagnetic wave when passing through a thin slice of the striation. From these measurements the conclusion must be drawn that within a small distance at the cathode side of the striation most of the electrons are accelerated to an energy of about 15 eV. Apparently over this distance, the time needed for Maxwellization of the electron energy is large in comparison with the transit time of the electrons. Author (NSA)

**N69-37337#** York Univ. (England). Dept. of Physics.

**TIME-RESOLVED MEASUREMENTS OF ELECTRON ENERGY DISTRIBUTIONS**

S. W. Rayment and N. D. Twiddy. *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 12 p refs (See N69-37326 22-25)

Avail: AEC Depository Libraries

A sampling technique was developed that enables time-resolved electron energy distribution measurments to be made by the Langmuir–Druyvesteyn probe method. The results obtained with this method compare favorably with energy distribution measurements obtained previously in stationary striations. The technique is described. NSA

**N69-37340#** Technische Hogeschool, Eindhoven (Netherlands).

**A RANDOM WALK TOWARDS A SIMPLE STATIONARY ELECTRON ENERGY DISTRIBUTION**

F. J. de Hoog. *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 7 p refs (See N69-37326 22-25)

Avail: AEC Depository Libraries

The electron energy distribution in Townsend discharges is studied. A brief mathematical analysis is presented. NSA

**N69-37342#** McDonnell-Douglas Co., St. Louis, Mo.

**ENERGY DISTRIBUTION FUNCTION FOR WEAKLY IONIZED GASES**

S. G. Ellomose (Strasbourg Univ.) *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 17 p refs (See N69-37326 22-25)

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Considering the steady state case and including both elastic and inelastic collisions, a much easier method is used to obtain

exactly the same two differential equations derived by Holstein for weakly ionized gases in the presence of an applied dc field. The distribution function depends on the momentum transfer cross section $Q_D$ as well as on the excitation cross section $Q_n$ to the different electronic excited states in the case of atomic gases. For the elastic scattering, these two equations give the same solution of the distribution function as that of Morse, Allis, and Lamar. The solution of Allis et al. is used to calculate the energy distribution functions, electron mean energies, drift velocities, and electron temperatures for different values of E/P. The strength E of the applied electric field is given in V/cm and the pressure P of the gas in torr. The results are strongly dependent on the data of $Q_D(\epsilon)$, where $\epsilon$ is the electron energy in eV. With $Q_{DA}(\epsilon) \propto 1/\epsilon^{1/2}$ for $\epsilon > 40$ eV, the recent data of Frost and Phelps for the momentum transfer cross section give the best agreement with experiment. Author (NSA)

**N69-37388#** International Centre for Theoretical Physics, Trieste (Italy).

**QUARK MODEL, PARTIAL SYMMETRY AND A UNIFIED SCHEME FOR PBB SUB L AND VBB SUB L**

A. N. Mitra Jun 1969 20 p refs Submitted for publication

(IC/69/49) Avail: CFSTI

The general ideas of the quark model used previously for the construction of couplings of baryons (B) and their resonances ($B_L$) to pseudoscalar (P) mesons are extended to include their couplings also to vector mesons (V) through Schwinger's partial-symmetry method which provides a simple means of relating the $VBB_L$ to the $PBB_L$ vertices. The model is applied to the N modes of several N- and δ-type resonances, via the $N_D$ mechanism. The results suggest that, analogously to the 3π case, an $N_D$ intermediate state, even when energetically forbidden, could still provide an important alternative to the mechanism for N modes. Author (ESRO)

**N69-37400#** Reactor Centrum Nederland, Petten.

**EXPERIMENTS WITH POLARIZED THERMAL NEUTRONS**

K. Abrahams May 1969 58 p refs

(RCN-105) Avail: CFSTI

This report describes the development of a mirror system, installed at the high flux reactor, giving an intense beam of polarized thermal neutrons. In addition, some experiments performed with this system are described. In two introductory chapters a more general survey is given of nuclear physics experiments with polarized thermal neutrons and of the methods to produce these neutrons. After a treatment of the mirror system in the third chapter, the measurement of the circular polarization of capture γ radiation is presented in the last chapter. From the results it was possible to assign spin values to excited states in $^{40}K$, $^{41}Ca$, $^{49}Ti$, $^{60}Co$, $^{114}Cd$ and $^{208}Pb$. Author (ESRO)

**N69-37411#** International Centre for Theoretical Physics, Trieste (Italy).

**GENERAL MULTIPOLE VIBRATIONS IN DEFORMED NUCLEI**

P. O. Lipas and K. Kurki-Suonio (Helsinki Univ.) May 1969 15 p refs Submitted for publication Sponsored partly by Finn. NRC for Sci. Supported in part by Finn. NRC for Sci.

(IC/63/37) Avail: CFSTI

Earlier work on the K = 1,2,3 octupole states is generalyzed for all multipoles (axial degrees of freedom are trivial in the model). To the extent that the states involved are contained in the model, its predictions (branching rules etc.) are those of the usual Bohr-Mottelson strong-coupling model. It is demonstrated and it contains the $(-)^{J+1}J(J+1)$ energy correction for K = 1. Author (ESRO)

**N69-37412#** International Centre for Theoretical Physics, Trieste (Italy).

**ELECTROMAGNETIC MASS SHIFTS IN NON-LAGRANGIAN FIELD THEORY**

O. Steinmann May 1969 34 p refs Submitted for publication

(IC/69/41) Avail: CFSTI

The electromagnetic interactions of hadrons are considered in a model in which both the hadrons and the photons are spinless. The perturbation theory of this model is developed in a way which takes the strong interactions rigorously into account. An expression for the second-order electromagnetic mass shifts of the hadrons is derived. The customary formula expressing these mass shifts as integrals over the Compton scattering amplitude is shown to be inaccurate. The correct expression differs from the old one by a changed integration contour. In favourable cases the two expressions coincide if the integrations over the four components of the photon momentum are carried out in a certain order. This order of integration must in general not be changed. Author (ESRO)

**N69-37419#** Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.

**DUALITY, ABSENCE OF EXOTIC RESONANCES, AND DELTA I EQUALS 1/2 RULE IN NON-LEPTONIC DECAYS**

Ken Kawarabayashi and Kitakado Jun. 1969 8 p refs

(RIFP-90) Avail: CFSTI

Based on current-current theory of weak interactions $\Delta I = 1/2$ rule for non-leptonic decays is derived from a dynamical mechanism that satisfies duality and absence of resonances in exotic channels. Author

**N69-37424#** International Centre for Theoretical Physics, Trieste (Italy).

**ON NON-LINEAR REALIZATIONS OF THE GROUP SU(2)**

J. Mickelsson and J. Niederle Jun. 1969 25 p refs Submitted for publication Sponsored in part by the Finn. Cult. Foun.

(IC-69-48) Avail: CFSTI

The nonlinear realizations of compact connected Lie groups are considered mainly from the point of view of algebraic topology. In particular, all homogeneous spaces of the group SU(2) are listed, the construction of a few nonlinear realizations of SU(2) is given, and the orbit structure of linear and nonlinear realizations is discussed. Author (ESRO)

**N69-37440*#** Princeton Univ., N.J.

**SYSTEMS OF SELF-GRAVITATING PARTICLES IN GENERAL RELATIVITY AND THE CONCEPT OF AN EQUATION OF STATE**

Remo Ruffini and Silvano Bonazzola (Rome Univ.) [1969] 65 p refs Presented at the CNES Colloq. on Weak Magnetic Fields, Paris, 20-23 May 1969 Submitted for publication Sponsored by NASA and ESRO

(NASA-CR-108834) Avail: CFSTI CSCL 20H

A method of self-consistent fields is used to study the equilibrium configurations of a system of self-gravitating scalar bosons or spin 1/2 fermions in the ground state without using the traditional perfect fluid approximation or equation of state. The many particle system is described by a second quantized free field which in the boson case satisfies the Klein-Gordon equation in general relativity, and in the fermion case the Dirac equation in general relativity. The coefficients of the metric are determined by the Einstein equations with a source term given by the mean value of the energy momentum tensor operator constructed from the scalar or the spinor field. The state vector corresponds to the ground state of the system of many particles. In both cases, for completeness, a nonrelativistic Newtonian approximation is developed and the corrections due to special and general relativity explicitly pointed out. Author (ESRO)

**N69-37533#** Aerospace Corp., San Bernardino, Calif. San Bernardino Operations.

**COMPTON BACK-SCATTERED (CBS) SOFT X-RAY SOURCE**

Technical Report, Sep. 1968 - Feb. 1969

Sidney W. Kash 12 May 1969 25 p refs
(Contract F04701-68-C-0200)
(AD-689237; TR-0200(S4309)-2; SAMSO-TR-69-193) Avail: CFSTI CSCL 20/8

Low energy X-rays can be produced by Compton back-scattering a laser beam off a beam of relativistic electrons. It appears feasible by this method to provide fluences sufficient for the study of the effects of X-rays on small material samples. The underlying principles of this X-ray production technique and estimates of obtainable fluences are presented. Several areas for further study and methods to enhance the X-ray fluence are indicated.
Author (TAB)

**N69-37538#** International Centre for Theoretical Physics, Trieste (Italy).
**QUARKS AND COUPLINGS AMONG HADRONS**
A. N. Mitra Jun. 1969 36 p refs Presented at the Intern. Conf. on Symmetries and Quark Models, Detroit, 18–20 Jun. 1969 (IC-69-43) Avail: CFSTI

A quark model has been used to construct hadron couplings to provide information on the decay widths of various resonances. This method, although being no substitute for a proper theory, is very sensitive to the quantum number assignments of many resonances, and it points to desirable features of a proper theory. It already seems to provide valuable support for the SU(6) x O(3) classification for hadron resonances. It also gives sharper parametrization of form factors and insight concerning the role of quarks in baryon coupling.
ESRO

**N69-37683#** Aktiebolaget Atomenergi, Stockholm (Sweden).
**TRANSITION RATES IN DY 161**
V. Berg and S. G. Malmskog Jun. 1969 33 p refs Submitted for publication
(AE-383) Avail: CFSTI

The decay of $^{161}$Tb has been studied using a high resolution Ge(Li)-detector. Five new transitions were observed and fitted into the earlier proposed decay scheme. The half-life of the 131.8 keV level in $^{161}$Dy was determined in a delayed coincidence measurement to be 145 ± 15 psec. The low level scheme in $^{161}$Dy is discussed within a quasi-particle model allowing for Coriolis mixing. Special attention is given to the strongly retarded, K-allowed 131.8 keV E 1 transition with a retardation factor $F_W > 1.5 \times 10^8$.
Author (ESRO)

**N69-37825#** Kent State Univ., Ohio. Dept. of Physics.
**MULTIPOLE PRECESSION SINGLE QUANTUM ANNIHILATION OF POSITRONS IN VARIOUS ATOMIC SHELLS Final Report, 1 Sep. 1964 – 31 Mar. 1969**
David S. Moroi Jun. 1969 6 p refs
(Grants AF-AFOSR-774-65; AF-AFOSR-774-67)
(AD-689288; AFOSR-69-1281TR) Avail: CFSTI CSCL 20/8

The report summarizes studies in multipole precession and single quantum annihilation of positrons.
TAB

**N69-37727#** Pisa Univ. (Italy).
**ON THE MAGNETOGRAVITATIONAL INSTABILITY ACCORDING TO JEANS LAW FOR A COMPRESSIBLE DISPERSION MEDIUM [SULLA INSTABILITA MAGNETO-GRAVITAZIONALE SECONDO JEANS DI UN MEZZO COMPRIMIBILE DISSIPATIVO]**
Guilio Mettel 1967 13 p refs in ITALIAN; ENGLISH summary Its Ser. 24, No. 1184
Avail: CFSTI

The simultaneous or separate influence of viscosity and finite electrical conductivity on Jeans' criterion for the magnetogravitational instability is examined in the case when the wave-number vector, the magnetic field and the rotation vector are oriented in space. Several particular cases are examined.
Author

**N69-37795*#** Alabama Univ. Research Inst., Huntsville.
**KRONECKER-DELTA TERMS IN THE PERIPHERAL MODEL AND DISPERSION RELATIONS**
J. Edwin Rush, Jr. [1969] 3 p refs
(Grant NGR-01-002-063)
(NASA-CR-105895) Avail: CFSTI CSCL 20H

In a recently published work, a reason was suggested for omitting Kronecker-δ terms in single-particle exchange calculations with or without absorption, and it was pointed out in particular that form factors diminish the effect of such terms. In the present paper it is demonstrated that Kronecker-δ terms do not arise if the peripheral contributions are calculated from unsubtracted dispersion relations.
K.W.

**N69-37805#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
**STUDY BY PHOTO-IONIZATION OF SOME SIMPLE POLYATOMIC MOLECULES AND CALCULATION OF THE FRANCK-CONDON FACTORS [ETUDE PAR PHOTOIONISATION DE QUELQUES MOLECULES POLYATOMIQUES SIMPLES ET CALCUL DES FACTEURS DE FRANCK-CONDON]**
Rene Botter (Ph.D. Thesis–Paris Univ., 26 Feb. 1968) Jun. 1969 82 p refs In FRENCH; ENGLISH summary Prepared with the Natl. Bur. of Std., Washington
Avail: CFSTI

The photo-ionization yield curves for $C_2H_2$, $C_2D_2$, $C_2H_4$ and $C_2H_2D_2$ have been determined using a mass spectrometer coupled with an U. V. monochromator. Besides exhibiting a staircase structure near threshold due to the excitation of vibrational levels in the ion ground state, all the curves have broad maxima corresponding to auto-ionization phenomena. The ionization potentials of these molecules have been measured, together with the appearance potentials of the main ionfragments. The excitation probabilities for the vibrational levels during ionization, or Franck-Condon factors, have been calculated for $C_2H_2$ and $C_2D_2$ using the method developed by Sharp and Rosenstock. Good agreement is generally obtained between the calculated values and those obtained experimentally from the photo-ionization yield curves. This calculation method is then extended to the case where the electronic transition occurs with changes in the geometrical structure of the molecule (in particular, changes of symmetry). The Franck-Condon factors have been determined for $NH_3$ (symmetry changes) and for $H_2O$ (changes in the equilibrium angle). Calculations show that there is generally considerable excitation of the combination bands.
Author (ESRO)

**N69-37814#** Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
**PROPERTIES AND INTERACTIONS OF NEW PARTICLES Final Report**
Aihud Pevsner May 1969 12 p refs
(Grant AF-AFOSR-234-65)
(AD-689425; AFOSR-69-1584TR) Avail: CFSTI CSCL 20/8

The general objective of the research is to study the nature of fundamental particles and their production mechanisms. A counter experiment was completed relating the basic coupling constant of some of these mesons to electro-magnetic forces. In addition a search for new mesons gave a negative result for strangeness plus one baryons, but did produce recently discovered Q and L mesons and a possible new candidate for a negative 1 meson. Various properties of these particles and their production mechaniams were determined.
TAB

**N69-37845#** Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
**RADIALLY EXCITED SU(3)-MULTIPLETS AND BARYON RESONANCES CLASSIFICATION**
Masayuki Kaiba Aug. 1969 22 p refs
(RIFP-91) Avail: CFSTI

The classification of 23 nucleonic resonances is tried on the basis of a simple model. The mass level of nucleonic resonances

except for five resonances are fitted within 60MeV. In relation to the result, several concluding remarks are given. Author

**N69-37849#** Rochester Univ., N.Y. Nuclear Structure Research Lab.

**A DIRECT MEASUREMENT OF PARTICLE-HOLE IMPURITIES IN THE GROUND STATE OF O-16 Interim Scientific Report**

K. H. Purser, W. P. Alford, D. Cline, H. W. Fulbright, H. E. Gove et al 1 Jul. 1969 25 p refs
(Contract AF 49(638)-1707)
(AD-689433; UR-NSRL-16; AFOSR-69-1617TR) Avail: CFSTI
CSCL 20/8

The pickup reactions 16O(d,t)15O and 15O(d,3He)15N were investigated at a deuteron energy of 20 MeV to allow a direct measurement of the two-particle two-hole admixtures in the ground state wave function of 16O. The results give good evidence for the existence of such pair excitations with intensities comparable to those predicted by Brown and Green. Author (TAB)

**N69-37850#** Rochester Univ., N.Y. Nuclear Structure Research Lab.

**STRUCTURE OF LOW LYING STATES IN A EQUALS 15 NUCLEI**

W. P. Alford and K. H. Purser 1 Jul. 1969 25 p refs
(Contract AF 49(638)-1707)
(AD-689434; UR-NSRL-17; AFOSR-69-1618TR) Avail: CFSTI
CSCL 20/8

States in 15O up to 8.32 MeV excitation have been studied in the 14N(3He,d)15O reaction at 14 MeV. States in 15N up to 6.33 MeV excitation were observed in the reaction 14C(3He,d)15N at the same energy. Angular distributions were measured between 10 degrees and 40 degrees lab, and l values and spectroscopic factors were obtained by comparison with DW calculations. The results have been compared with the results of several calculations for A = 14 ground state wave functions. Spectroscopic factors for transitions to even parity states in A = 15 nuclei are in excellent agreement with calculations of Halbert and French. Author (TAB)

**N69-37856#** Sandia Corp., Albuquerque, N.Mex.

**DETERMINATION OF BREMSSTRAHLUNG PRODUCTION EFFICIENCIES FROM DATA OBTAINED ON PHERMEX AT 27 MeV**

T. H. Martin May 1969 8 p refs
(SC-DR-69-240) Avail: CFSTI

Recent experiments conducted at Los Alamos Scientific Laboratory on the PHERMEX installation and analyzed with a Sandia Laboratories computer program indicate that the generally accepted bremsstrahlung production efficiency versus voltage curve needs corrections at voltages above approximately 13 MeV. Analysis of the data shows that electron beam divergence angles must be taken into account and subsequently indicates that a 2-degree average beam divergence angle exists on PHERMEX. When the beam divergance is eliminated the bremsstrahlung production efficiency curve can be represented by the relatively simple equation $D/Q = 1.1 \times 10^3 V^{2.8}$ for at least $1 \leq V \geq 27$ where V is given in megavolts, D in roentgens, and Q in coulombs. Author (NSA)

**N69-37888#** Brookhaven National Lab., Upton, N.Y.

**SIGNAL FILTERING-HIGH COUNTING RATE PROBLEMS**

V. Radeka [1968] 27 p refs Presented at the Intern. Symp. on Nucl. Electron., Versailles, France, 10-13 Sep. 1968
(BNL-13883; CONF-680906-21) Avail: CFSTI

Comments on optimum signal processing for pulse amplitude spectometry at high rates are presented. Discussed are signal processing and the weighting function; signal detection, timing, and amplitude measurements; pileup rejection; and realization of weighting functions and systems considerations including both time-invariatn and time-variant filters. NSA

**N69-37890#** Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

**HYPERFINE COUPLING IN GADOLINIUM-PRASEODYNIUM ALLOYS BY SPECIFIC HEAT MEASUREMENTS [ETUDE COUPLAGE HYPERFIN DANS LES ALLIAGES GADOLINIUM-PRASEODYME PAR MESURES DE CHALEUR SPECIFIQUE]**

Jean-Claude Michel (Ph.D. Thesis--Grenoble Univ., 7 Dec. 1967) Jul. 1969 103 p refs In FRENCH; ENGLISH summary
(CEA-R-3538) Avail: CFSTI

The hyperfine coupling in gadolinium-praseodymium alloys has been studied by specific heat measurements down to 0.3°K and the apparatus is described. Praseodymium has been studied in detail because it is an exception in the rare earth series. Author (ESRO)

**N69-37899#** Mound Lab., Miamisburg, Ohio.

**EVALUATION OF NEUTRON RADIOGRAPHY FOR RADIOISOTOPIC HEAT SOURCES**

A. G. Barnett, A. R. Bauer and M. I. Gray 5 Jun. 1969 20 p
(Contract AT(33-1)-GEN-53)
(MLM-1617) Avail: CFSTI

Neutron radiography was evaluated for application on isotopic heat sources. Three specimens were radiographed: a Haynes alloy No. 25 container filled with a 50-50 wt % mixture of tungsten and molybdenum; a tantalum-10 wt % tungsten cylinder with a welded end cap, and a radioactive heat source containing three small capsules of $^{238}Pu$ metal. Neutron radiographs were compared with gamma and x-ray radiographs and were found to compete favorably in most cases. Author (NSA)

**N69-37902#** Oak Ridge National Lab., Tenn. Neutron Physics Div.

**AVKER: A PROGRAM FOR DETERMINING NEUTRON KERMA FACTORS FOR USE IN ENERGY DEPOSITION CALCULATIONS**

M. Solomito, J. J. Ritts, and H. C. Claiborne 15 Apr. 1969 33 p refs Sponsored in part by DASA and AEC
(ORNL-TM-2558) Avail: CFSTI

The Fortran code AVKER calculates neutron kerma factors which may be used to determine dose or heat generation rates in materials. The program allows the evaluation of the kerma factors for any desired composition that can be made up from elements presently available in the kerma library and for any arbitrary group structure within the energy limits of 0.023 eV to 16.2 MeV. Author (NSA)

**N69-37904#** Gulf General Atomic, San Diego, Calif.

**CESIUM SORPTION IN MATERIALS FOR INTEGRAL RESERVOIRS**

M. K. Yates and G. O Fitzpatrick Oct. 1968 26 p refs Presented at the IEEE Thermionic Conversion Specialist Conf., Boston, Mass.
(Contract AT(04-3)-167)
(GA-8771; CONF-681059-2) Avail: CFSTI

The cesium vapor pressure/sample temperature/sample loading characteristics were measured for several types of graphite. The isotherms for different types of graphite were similar, but the transition between two cesium - graphite equilibrium states was better defined in some samples than in others. Hysteresis effects were present in most samples but appear to pose no particular problems to the thermionic converter. A long-term thermal stability test was begun on one sample of graphite, which was operated at 775°C at a cesium vapor pressure of 10 torr. No changes were detected in the sample's pressure temperature characteristics over 3380 hours of operation. The required temperature control accuracy for some sorption reservoirs is shown to be approximately one-half that required for a liquid cesium reservoir, and tolerable cesium losses in sorption reservoirs are given for a given cesium vapor pressure change. Author (NSA)

**N69-37906#** Oak Ridge National Lab., Tenn. Physics Div.
**REVISED ZERBY-MORAN CODE FOR CALCULATING THE RESPONSE OF SODIUM IODIDE CRYSTALS TO GAMMA RAYS**
John L. Rodda, II Jun. 1969 41 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2579) Avail: CFSTI

A description is given of the input format and output features of a revised version of the Zerby–Moran code for calculating the response of sodium iodide scintillators to gamma rays of energies up to 10.22 MeV. Two versions of the code (called MORN) are available, one for the CDC 1604-A computer and one for the IBM 360/75 (ORNL compiler). Output options include 8-1/2 by 11 inch semi-log plots (histograms) of the unbroadened Compton spectrum (without the effects of secondary radiations) and of the total response spectrum (including the effects of detector resolution). A plot of the unbroadened Compton spectrum (with secondaries) with error flags is also available. The printed output includes not only the intrinsic efficiency and the photofraction but also the first and second escape peak efficiencies. A complete guide to the use of a versatile plotting package (SKETCH) is also given. This package can be used independently of the MORN code and will run on either the CDC 1604-A or the IBM 360/75 computer. Author (NSA)

**N69-37925#** Internstional Centre for Theoretical Physics, Trieste (Italy).
**NUMBER-CONSERVING APPROXIMATION TO SHELL MODEL**
Y. K. Gambhir, A. Rimini, and I. Weber
Jun. 1969 30 p refs Submitted for publication Supported in part by Ist. Nazl. di Fis. Nucl.
(IC/69/9) Avail: CFSTI

The broken pair approximation (BPA) formalism is presented in this paper in complete form for the description of the nuclear properties of medium and heavy spherical nuclei. Starting from an approximate ground state of even nuclei having BCS-type pair distribution in the valence shells, the Hilbert space model is constructed by replacing one, two.... pairs in the assumed approximate ground state by any valence two-, four-, .... particle configurations. All the relevant expressions for calculating energy matrices, transition rates, inelastic electron-scattering form factors and spectroscopic factors for one- and two-nucleon transfer reactions are presented in a coherent form. The corresponding expressions for the case of first BPA are further elaborated and presented in a form suitable for numerical computation. Author (ESRO)

**N69-37938#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
**CONTRIBUTION TO THE STUDY OF THE ELASTIC AND INELASTIC SCATTERING WITH A BEAM OF POLARIZED PROTONS [CONTRIBUTION A L'ETUDE DE LA DIFFUSION ELASTIQUE ET INELASTIQUE AVEC UN FAISCEAU DE PROTONS POLARISES]**
Rene de Swiniarski (Ph.D. Thesis-Paris Univ., 17 Oct. 1967) May 1969 112 p refs In FRENCH; ENGLISH summary
(CEA-R-3456) Avail: CFSTI

The elastic and inelastic scattering of the 18.6 MeV polarized proton beam from the Saclay variable energy cyclotron has been studies for the following nuclei: $^{48}$Ti, $^{50}$Ti, $^{52}$Cr, $^{54}$Fe, $^{56}$Fe, $^{58}$Ni, $^{62}$Ni, $^{64}$Ni, $^{63}$Cu; the targets $^{52}$Cr, $^{60}$Ni and $^{62}$Ni have also been investigated at 16.5 MeV. The measured asymmetries for the strong $l = 2$ transitions tend to fall into two categories, distinguished by the magnitude of the asymmetries at 30° and 90°. For the transitions studied, only those to the first $2^+$ state of the 28-neutron nuclei present large asymmetries at these angles. Strong $l = 3$ and $l = 4$ transitions also show interesting variations. When the entire optical potential is deformed, coupled channels of DWBA calculations predict the 'small' $l = 2$ asymmetry reasonably well, but only an abnormal increase of the strength of the spin-orbit distortion or the introduction of an imaginary and negative spin-orbit potential can reproduce the amplitude of the large asymmetries. Calculations with a microscopic model indicate that the asymmetry is sensitive to the form factor and no important differences were found between $S = 0$ and $S = 1$ predictions. Author (ESRO)

**N69-37958#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**AN X-RAY TECHNIQUE FOR MEASURING THICKNESS OF TUNGSTEN ON COPPER**
B. E. Foster and S. D. Snyder Jun. 1969 11 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2524) Avail: CFSTI

An X-ray attenuation technique to measure the thickness of vapor-deposited tungsten on the inside wall of copper tubing was developed. The radiation source was a Norelco MG-150 X-ray unit operated at 150 kVcp and 3 ma with copper filtration to reduce the overall beam intensity and absorb the low-energy X-rays. Narrow beam collimation was used and directed the beam radially into the duplex tube. The detector, placed in the bore of the tube, consisted of a NaI(Tl) crystal optically coupled to a commercial fiber optics bundle. The bundle was optically coupled to a photomultiplier tube. The output signal from the photomultiplier was monitored by a digital voltmeter. The detector was held stationary in the beam and positioned for maximum signal. The tube to be measured was translated with the detector remaining on the axial center of the tube. Measurements were made at specified circumferential and longitudinal positions. Our calibration curve was obtained by plotting the voltmeter reading versus the thickness of rolled tungsten sheep specimens. Author (NSA)

**N69-37992#** International Centre for Theoretical Physics, Trieste (Italy).
**ELASTIC SCATTERING OF PIONS ON $He^4$ AT SMALL MOMENTUM TRANSFER**
H. Baier and V. K. Samaranayake Jul. 1969 24 p refs Submitted for publication
(IC/69/60) Avail: CFSTI

Using Glauber multiple scattering theory, the spin effects on elastic $He^4$ scattering at small momentum transfer are investigated in the region $.826 \leq q \leq 2.01$ GeV/c pion lab. momentum. Spin effects are shown to be negligible even at .826 GeV/c where the spin flip part of the pion nucleon amplitude is found to be relatively maximal. The use of an 'effective' pion nucleon amplitude is shown to be a good approximation for scattering at small momentum transfer, thus facilitating the investigation of nuclear correlation effects with $\pi$ $He^4$ scattering experiments. Author (ESRO)

**N69-37998#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
**CONTRIBUTION TO $\pi^+p$ INELASTIC SCATTERING AT INCOMING PION ENERGIES NEAR 1 GeV [CONTRIBUTION A LA DIFFUSION INELASTIQUE $\pi^+p$ POUR DES ENERGIES DU $\pi$ INCIDENT VOISINES DE 1 GeV]**
Bernard Delor (Ph.D. Thesis-Paris Univ., 14 Jun. 1968) May 1969 101 p refs In FRENCH; ENGLISH summary
(CEA-R-3579) Avail: CFSTI

Results on $\pi^+p$ scattering at 810 and 1300 MeV incoming kinetic energy are presented. Author (ESRO)

**N69-38011*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**CALCULATION ON IONIZING H-ATOM H-ATOM COLLISIONS**
K. Omidvar and H. Lee Kyle Sep. 1969 26 p refs Submitted for publication
(NASA-TM-X-63683; X-641-69-381) Avail: CFSTI

The Born approximation is used to calculate the cross sections when an hydrogen atom in an excited state with the principal

quantum number n collides with an hydrogen atom in the ground state. Calculation has been carried out when the first atom is ionized while the second atom may have any final state. The cases considered are n = 1, 2, 3, and 4. A closure approximation originally used by Lodge is also used here for high impact energy calculations. We find disagreement with some of the Lodge's numerical results. At sufficiently high impact energies the cross sections are inversely proportional to the energies. Coefficients of proportionalities for all cases are given. The cross section is given as $Q_0 = 4(M/m)\,(\ln 4n^2 - 1/2)(\pi a_0^2)/K^2$, when the incident atom is in a high principal quantum number such that the relation $(m/M)\,K^2 a_0^2 > n^2 >> 1$ is satisfied, with $K^2$ the impact energy in rydberg, m and M the electronic and the atomic masses, and n the principal quantum number considered. Author

**N69-38020#** Commissariat à l'Energie Atomique, Bruyères-le-Chatel (France).

**ELASTIC AND INELASTIC SCATTERING OF 2 TO 10 MeV PROTONS BY LITHIUM ISOTOPES [DIFFUSION ELASTIQUE ET INELASTIQUE DES PROTONS DE 2 A 10 MeV PAR LES ISOTOPES DU LITHIUM]**

Michel Laurat (Ph.D. Thesis--Paris Univ., 7 Mar. 1968) May 1969 78 p refs In FRENCH; ENGLISH summary

(CEA-R-3727) Avail: CFSTI

A description is given of an experiment for carrying out spectrometric and absolute cross-section measurements on the reactions induced by protons accelerated in a 12 MeV Van de Graaff Tandem. The particles are detected by silicon junctions, the weight of the targets (about ten $\mu g/cm^2$) being determined by the quartz method. The experimental equipment has been controlled by a study of proton scattering by lithium-6, and has made it possible to evaluate the elastic and inelastic scattering (1st level excitation) by lithium-7 of 2-8 MeV protons. The most probable spin and parity values for the six levels of $^9Be$ between 19 and 25 MeV excitation energy have been determined from a knowledge of the observed structure. Author (ESRO)

**N69-38021#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

**PHOTON FLUX MEASUREMENTS RELATING TO BREMSSTRAHLUNG [MESURES DE FLUENCES DE PHOTONS RELATIVES A UN SPECTRE DE RAYONNEMENT DE FREINAGE]**

Gérard Merle and Jean-Claude Zarbib May 1969 36 p refs In FRENCH; ENGLISH summary

(CEA-R-3739) Avail: CFSTI

Using a gamma spectrometry apparatus and a NaI : Tl crystal, the passage from the pulse distributions received on a multichannel spectrometer to the spectral distribution of the photons has been studied. A previously calibrated gamma probe was used to measure the mono-energetic photon flux. A simple method was used for producing the spectrum with an energy range 30 keV-2 MeV; the photon population was classified in about twenty groups. The determination of these groups, whose width increases with the energy $E_\gamma$, depends on the probe parameters and on the probability used for the calculation of the Gaussian distribution of the pulses of the total absorption peak, centered on the group under consideration. The spectral analysis method is tested for one and then several radionuclides which are simultaneously present and whose gamma emission is known. The tests are complemented with flux measurements with a view to testing the validity of the proposed method. The class determination operation (number and width), and the calculation of the spectral distribution of the photon flux and of the irradiation intensities are carried out by computer (FORTRAN IV program). An actual example is described for measuring the bremsstrahlung near the 2 MeV 'YVETTE' Van de Graaff machine at the Saclay Nuclear Sciences and Technology Institute (INSTN). Author (ESRO)

**N69-38030#** Naval Research Lab., Washington, D.C. Nuclear Physics Div.

**REPORT OF CYCLOTRON OPERATION, 1 July - 31 December 1968**

Mar. 1969 67 p refs

(AD-689732; NRL-MR-1982) Avail: CFSTI CSCL 20/7

The operation and use of the NRL Sector-Focusing Cyclotron is described for the period 1 July - 31 December 1968. An active research program consisting of five experimental studies was initiated and vigorously pursued during this period. Several additional experiments were designed and equipment procurement was initiated. An average operational efficiency of 84% was reached for the entire cyclotron facility. The extended operation for research purposes has furnished valuable data on stability and reliability of the magnet power supplies and R. F. system. The beam path into Room 1 became operational in December and is used primarily for radioisotope production. Plans are being developed for future installation of additional beam paths into Rooms 2 and 3. These beam paths are necessary for starting new research programs. Author (TAB)

**N69-38037#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

**DATA PROCESSING IN GAMMA SPECTROMETRY. APPLICATION TO THE DECAY SCHEMES [ETUDE TRAITEMENT DES INFORMATIONS EN SPECTROMETRIE GAMMA. APPLICATION A L'ETUDE DES SCHEMAS DE DESINTEGRATION]**

Jean-Pierre Boulenger (Ph.D. Thesis--Paris Univ., 21 Jun. 1968) Jun. 1969 266 p refs In FRENCH; ENGLISH summary

(CEA-R-3690) Avail: CFSTI

This report concerns the processing of the data from a gamma spectrometer, and its application to decay schemes. The mathematical analysis of the full energy peaks, linked with the very good resolution of semiconductor detectors, leads to very accurate energy determinations. The resolution of complex spectra by the least squares method, completed by a spectra generating process, permits the calculation of branching ratios, and the analysis of the two-dimensional experiments reveals the coincidences. For each of these methods, the calculation principles, the systematic tests as well as experimental results are presented. The energies of some nuclides, frequently used as standards have thus been measured and the decay schemes of $^{134}Cs$ and $^{110m}Ag$ determined precisely. Author (ESRO)

**N69-38039#** Aktiebolaget Atomenergi, Stockholm (Sweden).

**ON PHONONS IN SIMPLE METALS. PART 2: CALCULATED DISPERSION CURVES IN ALUMINIUM**

Rune Johnson and Asser Westin (Uppsala Univ.) Jul. 1968 123 p refs

(AE-365) Avail: CFSTI

The real part of the dynamical matrix, derived earlier in a weak local potential ion-electron interaction model of the metal, is investigated in the case of aluminium. It is shown that the free electron, or Lindhard, dielectric function leads to a picture of the metal which is inconsistent with the dHvA observations of the Fermi surface. By adjusting one parameter, however, the experimental phonon frequencies are reproduced satisfactorily. Even some simple structure in the derivative $d\omega/dq$ can be reproduced in this way. Although corrections to the Lindhard dielectric matrix give no essential contributions to the dynamical matrix, the first order corrections, which are the most important, can explain the observed Fermi surface. Much of the observed structure in the phonon dispersion curves seems also to be due to these non-diagonal terms in the dielectric matrix. Author (ESRO)

**N69-38087#** Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

**STUDY OF THE REACTION NEGATIVE PION PLUS PROTON YIELDS NEGATIVE PION PLUS NEUTRAL PION PLUS PROTON AT 2.77 GEV/C FOR LOW MOMENTUM TRANSFER TO THE PROTON. APPLICATION TO THE**

**CHEW-LOW EXTRAPOLATION METHOD FOR THE NEGATIVE PION-NEUTRAL PION ELASTIC SCATTERING [ETUDE DE LA REACTION NEGATIVE PION PLUS PROTON YIELDS NEGATIVE PION PLUS NEUTRAL PION PLUS PROTON A 2,77 GEV/C POUR DE FAIBLES IMPULSIONS DU PROTON DIFFUSE. APPLICATION DE LA METHODE D'EXTRAPOLATION DE CHEW ET LOW A LA DIFFUSION ELASTIQUE NEGATIVE PION-NEUTRAL PION]**

Jean-Pierre Baton (Ph.D. Thesis--Paris Univ., 22 May 1968) Jun. 1969 99 p refs In FRENCH; ENGLISH summary
(CEA-R-3543) Avail: CFSTI

Study of the reaction $p \rightarrow p$ at 2.77 GeV/c carried out in the CERN 2-m liquid-hydrogen bubble chamber at the proton-synchrotron, shows that 70 per cent of this reaction goes through $p \rightarrow \rho p$ channel. The high statistics allow one to specify the mass and the width of the resonance. Whilst the production parameters are independent of the width, it is not the same for the decay parameters. The Chew-Low extrapolation method allows one to determine the elastic cross-section to the pole, and the phase shifts of the P waves in the isospin 1 state and S waves in the isospin 2 state. Author (ESRO)

**N69-38140#** Rochester Univ., N.Y. Nuclear Structure Research Lab.

**A DETERMINATION OF THE f SUB 7/2-d SUB 3/2 EFFECTIVE INTERACTION USING MULTIPOLE SUM RULE METHODS**

M. A. Moinester and W. P. Alford Aug. 1969 32 p refs Sponsored by NSF
(UR-NSRL-24) Avail: Issuing Activity

Using the multipole sum rule technique of French and Bansal, data from a number of nuclei in the sd shell have been analyzed to estimate the matrix elements of the $f_{7/2}$ $d_{3/2}$ effective interaction. The matrix elements obtained in this way are compared with those from other analyses using the more standard procedure of fitting energy levels, and reasonable agreement is obtained. A comparison with the results of reaction matrix calculations employing realistic two-body interactions is also presented. Author

**N69-38247#** California Inst. of Tech., Pasadena.

**TOPICS IN ALGEBRAIC PARTICLE PHYSICS. LECTURE 6: THE PARTICLE SPECTRUM FOR CONTRACTED CURRENT COMMUTATORS**

Yuval Ne'eman Jun. 1969 13 p refs Presented at 5th Finn. Summer School in Theoret. Phys., 1969
(Contract AT(11-1)-68)
(CALT-68-198) Avail: CFSTI

The possibility of keeping the Feynman et al. general suggestion with respect to the composition of the system of hadron states, while using contracted current commutators according to the Lee et al. ansatz rather than the original quark model commutators, is analyzed. The inhomogeneous algebra of integrated contracted current components and the SU(3) content of the irreducible unitary linear representation of $G: I^3_{3+1}$ SU(3) are considered. NSA

**N69-38252#** Brookhaven National Lab., Upton, N.Y.

**DESCRIPTION OF FINAL STATES WITH THREE, FOUR, AND FIVE PARTICLES IN PP INTERACTIONS AT 28.5 GeV/C**

W. E. Ellis, T. W. Morris, R. S. Panvini, and A. M. Thorndike [1969] 33 p Presented at the Intern. Conf. on Elementary Particles, Lund, Sweden
(BNL-13671; CONF-690608-2) Avail: CFSTI

Additional experimental findings concerning the final states $pn\pi+$, $pp\pi+\pi-$, and $pn\pi+\pi+\pi-$ from a continuing study of pp interactions at 28.5 GeV/c are presented. The diffraction-dissociation process appeared to account for most of the cross section in the $pn\pi+$ and $pp\pi+\pi-$ final states; for the five-body final state no strong clustering of particles at low mass was seen. It is found that the five-particle final state $pn\pi+\pi+\pi+\pi-$ has the characteristic shape of a diffraction-dissociation process in the $n\pi+\pi+\pi-$ mass spectrum, if it is recognized that this mass distribution is sufficiently broad so that it occupies a large part of the allowed mass region. The $n\pi^+$ and $p\pi^+\pi^-$ systems in the three- and four-body final states show a marked resonant-like structure near 1.4 GeV. A detailed survey of the mass and t distributions are emphasized, particularly for the $pn\pi^+$ and $pp\pi^+\pi^-$ final states. A Monte Carlo calculation, which uses an empirical formula based on the assumption of a diffraction-dissociation mechanism, gives a good gross description of distributions in the data. NSA

**N69-38253#** Atlantic Richfield Hanford Co., Richland, Wash.

**DC ARC EXCITATION OF IMPURITIES IN PLUTONIUM DIOXIDE USING CARRIER DISTILLATION TECHNIQUES**

R. L. Zilar [1969] 24 p refs Presented at the 24th Northwest Regional Meeting, Amer. Chem. Soc., Salt Lake City
(ARH-SA-32; CONF-690606-5) Avail: CFSTI

The effects of various carrier compounds and methods of preparation of plutonium dioxide on the spectral emission of trace metallic impurities were studied. By using an emission spectrometer, equipped with a chart readout, excitation rates were established for elements analyzed by the carrier distillation technique. This study showed that the use of 8.3% AgCl – LiF (1:1) in plutonium dioxide gives the most sensitive and reproducible excitation for the majority of impurity elements. By proper selection of the excitation period for each element, the effect of background radiation is reduced. Spectrometric calibration curves made using data obtained in this study have a relative error of ±30% at the 95% confidence interval. Author (NSA)

**N69-38256#** Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.

**THE EXCITATION AND IONIZATION OF IONS BY ELECTRON Technical Progress Report, 1 Sep. 1968 – 31 May 1969**

J. W. Hooper, J. C. Majure, D. Mc Pherson, and M. O. Pace 31 May 1969 32 p refs
(Contract AT(40-1)-3027)
(ORO-3027-15) Avail: CFSTI

Research conducted during the period in each of the following experimental areas is described briefly: (1) the development of facilities and techniques suitable for the determination of electron-collision data from magnetoplasma transient-response studies; (2) energy loss by protons and singly charged Li ions upon passage through thin films; and (3) the determination of absolute cross sections for excitation of $Ba^+$ ions by electron impact for electron energies near threshold for the processes of interest. The descriptions cover equipment and experimental methods; no results are given. NSA

**N69-38266#** Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.

**MATHEMATICAL SIMULATION OF TRACKS BY SPIRAL SCANNING**

G. A. Ososkov 1969 16 p refs In RUSSIAN
(JINR-P11-4463) Avail: AEC Depository Libraries

The equations and the probability algorithms for simulation of the numerical information received from the flying-spot digitizer with spiral scanning are presented. Tracks of events and the tracks of noninteracted beam particles are represented as circle segments; noise points are considered to fill the scanning field uniformly. Author (NSA)

**N69-38267#** Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

**PRODUCTION OF HIGHLY STRIPPED IONS IN ULTRAHIGH-VACUUM ELECTRON-BEAM SOURCE**

E. D. Donets, V. I. Ilyushchenko, and V. A. Alpert 1969 16 p refs In RUSSIAN
(JINR-P7-4489) Avail: AEC Depository Libraries

$C^{+6}$, $N^{+6}$, and $O^{+7}$ ions were observed at the output of the electron-beam ion source by working with the residual gas atoms. Detection of bare nuclei of C, N and O was made difficult due to the presence of intense $H^+ + 2$ line. In preliminary experiments on gold ionization the ions up to $Au^{+19}$ were obtained. The experimental value of the ionization cross section $N^{+5} \rightarrow N^{+6}$ which turned out to be anomalously large, is discussed. Author (NSA)

**N69-38268#** Kentucky Univ., Lexington. Dept. of Physics and Astronomy.

**RADIATION EFFECTS ON GERMANIUM Annual Report, 1 Jun. 1968-31 May 1969**

B. R. Gossick Feb. 1969 51 p refs

(Contract AT(40-1)-3651)

(ORO-3651-3) Avail: CFSTI

Measurements of the potential difference generated across germanium samples by a light probe reveal the presence of bulk inhomogeneities and surface flaws. Survey measurements have also been made in an effort to observe the Dember effect. Measurements of the Haynes–Shockley ambipolar carrier mobility against temperature in n-type germanium have been made before and after bombardment by fast neutrons. Preliminary results after bombardment with integrated flux of $10^{12}$ fast neutrons $cm^{-2}$ on a 5 ohm-cm and 20 ohm-cm resistivity sample show that mobility increases as observed by Closser at room temperature, but observations near liquid nitrogen temperature reveal that the mobility in the 5 ohm-cm sample decreases while the mobility in the 20 ohm-cm sample increases initially with bombardment. A method of determining the ambipolar diffusion coefficient by measuring the ambipolar diffusion length and the effective recombination time is described. Author (NSA)

**N69-38307#** United Kingdom Atomic Energy Authority, Harwell (England).

**TRACES OF SPIN OPERATOR PRODUCTS AND THEIR USE IN PHYSICAL PROBLEMS (SPHERICAL BASIS)**

N. W. Dalton and D. E. Rimmer Dec. 1968 248 p refs

(AERE-R-5958) Avail: CFSTI; UK 32s6d

The following traces of products of spin operators, $S_{\alpha\beta}$ were evaluated on a computer, $(\alpha 1, \alpha 2, \ldots \alpha n) = \text{Trace } |\rho_0 S_{\alpha 1} S_{\alpha 2} \ldots S_{\alpha n}|$ where $\alpha i = +1, 0, -1$ and $\rho_0$ is equal to either $(2S + 1)^{-1}$ or $e^{-\hbar\omega_0/kT}/e^{-\hbar\omega_0/kT}$. Physically L is proportional to an external magnetic field, H, acting in the z-direction. All possible traces of up to nine spin operators are tabulated for the finite field case ($L \neq 0$) and of up to twelve spin operators for the zero field case ($L = 0$). Different methods for evaluating the traces are described and examples of applications of these tables are given. Author (NSA)

**N69-38327#** Virginia Univ., Charlottesville. Research Labs. for Engineering Sciences.

**INTERACTION OF KeV IONS WITH GASES Progress Report, 1 Jun. 1968–31 May 1969**

John W. Boring Jun. 1969 42 p refs

(Contract AT(40-1)-2911)

(EE-3930-106-69-U; ORO-2911-11) Avail: CFSTI

Progress during the period is summarized on development of a method of measuring total ionization by heavy ions in gases, measurements of differential cross sections for scattering of ions in the keV range, and development of a theoretical description of the differential cross section for charge transfer. Some data on differential cross sections for scattering of $H^+$ by Ar are presented. A reprint of a published article describing ionization measurements in $CO_2$, $C_2H_4$, and $C_2H_2$ and a preprint of an article on use of the Thomas–Fermi model in analysis of ionization measurements are included as appendices. NSA

**N69-38331#** Michigan State Univ., East Lansing. Dept. of Physics and Astronomy.

**A STUDY OF THE PRODUCTION AND DECAY OF RESONANT STATES IN PERIPHERAL HIGH ENERGY COLLISIONS**

Glenn T. Williamson (Ph.D. Thesis) 1969 102 p refs

(Contract AT(11-1)-1061)

(COO-1061-32) Avail: CFSTI

The current theoretical situation in phenomenological analysis of high energy scattering is reviewed. Various attempts are made to improve upon several models. In particular, the effect of form factors and Regge treatment of propagators on Born amplitudes is examined. Higher-order exchange contributions are considered as possible solutions to the problem of energy dependence of higher spin-exchange amplitudes. It is found that a combination of the absorptive peripheral model and the Regge pole model is the most successful approach, in that energy dependence difficulties are eliminated as is the need for conspiring trajectories. Author (NSA)

**N69-38342#** Stanford Linear Accelerator Center, Calif.

**A STUDY OF LAMBDA p MASS SPECTRUM FROM THE REACTION NEGATIVE KAON DEUTERON YIELDS NEGATIVE PION PROTON LAMBDA AT REST**

Tai Ho Tan May 1969 9 p refs Submitted at Intern. Conf. on Hypernuclear Phys., Argonne, Ill., 5–7 May 1969 Sponsored by AEC

(SLAC-PUB-596; Conf-690503-2) Avail: CFSTI

An experiment for the study of hyperon nucleon production in $K^- + d \rightarrow \pi^- + p + \Lambda$ interactions at rest was performed using a deuterium bubble chamber. The results of this experiment are presented, in particular a detailed analysis of the $\Lambda p$ mass spectrum near the 2129 MeV region was studied to determine the nature of the observed enhancement. Author (NSA)

**N69-38343#** Oak Ridge National Lab., Tenn.

**STUDIES OF NEGATIVE ION-MOLECULE REACTIONS IN THE ENERGY REGION FROM ZERO TO THREE ELECTRON VOLTS**

J. A. D. Stockdale, R. N. Compton, and P. W. Reinhardt May 1969 155 p refs

(Contract W-7405-eng-26)

(ORNL-TM-2546) Avail: CFSTI

The dissociative attachment of electrons to molecules ($e + AX \rightarrow A^- + X$) was used to produce negative ions in the energy region from 0 to near 3 eV through impact of monoenergetic electrons on various molecular gases located in the source region of a time-of-flight mass spectrometer. After being produced in a short interval of time these primary ions were allowed to react for a controlled period with the molecular gas or gases present in the field-free reaction region. Sampling and measurement of both primary and secondary product ions as a function of the reaction time yielded the rate of the reaction and knowledge of the primary-ion velocity permitted calculation of the reaction cross section. Cross sections of the reactions $H^- + H_2O \rightarrow OH^- + H_2$, $D^- + D_2O \rightarrow OD^- + D_2$, and $O^- + NO_2 \rightarrow O$ have been measured at a number of points in the energy region from 0 to 3 eV and the cross sections or rates of various other reactions have been measured at a single primary ion energy. These results are compared with theoretical predictions. Author (NSA)

**N69-38349#** Oak Ridge National Lab., Tenn. Atomic and Molecular Processes Information Center.

**BIBLIOGRAPHY OF ATOMIC AND MOLECULAR PROCESSES FOR JULY–DECEMBER 1968**

Jun. 1969 243 p refs

(ORNL-AMPIC-12) Avail: CFSTI

Part 1 of this publication is an annotated bibliography containing references of interest to atomic and molecular collision research. The references are classified into twelve major categories with appropriate subcategories. Each entry in the respective category is entered alphabetically by first author and includes the reactions of the collision process. Part 2 of a listing of scientists engaged

in or interested in the field of atomic and molecular collisional physics. Part 3 lists Russian scientists engaged in atomic collision physics; the listing is obtained from publications and scientific conferences. Author (NSA)

**N69-38349#** California Inst. of Tech., Pasadena. Arthur A. Noyes Lab. of Chemical Physics.
**APPLICATION OF ION CYCLOTRON RESONANCE TO THE STUDY OF ION-MOLECULAR INTERACTIONS Technical Progress Report, 1 Feb. – 31 Dec. 1968**
Jesse L. Beauchamp 31 Dec. 1968 38 p refs
(Contract AT(04-3)-767)
(CALT-767-3) Avail: CFSTI

An ion cyclotron resonance spectrometer was installed. Auxiliary equipment includes a pulsed radiofrequency apparatus, a bridge spectrometer, a metastable beam source, a photoionization source, and an apparatus for studying the beta decay of tritiated species. Ion cyclotron single and double resonance spectroscopy were employed to identify and study the kinetics and energetics of ion – molecule reactions. The ionization and ion chemistry of isopropyl alcohol were studied. Proton affinities of organic molecules in the gas phase were investigated. The product distributions from the reactions of $H^+_3$ and $D^+_3$ with a series of hydrocarbon molecules were determined using the pulsed ion ejection technique. The initial distribution and subsequent reactions of the ionic fragments derived from photoionization of 2-butanol were investigated. Author (NSA)

**N69-38368#** Israel Atomic Energy Commission, Tel Aviv.
**PREPARATION OF SELF-SUPPORTED TANTALUM OXIDE FILMS**
A. Aladjem Dec. 1968 5 p refs
(IA-1155) Avail: AEC Depository Libraries

A technique was developed for producing self-supporting tantalum oxide films of either natural oxygen isotopic composition or labeled with specific O isotopes. The technique is based on anodizing and subsequent electrolytic dissolution of the base metal. Films up to 6 mm in diameter and 60 to 3000 Angstrom thick are now in limited-scale production. The films show low permeability to radon and a fairly high mechanical strength. The possible uses of the films are mainly as covers for radioactive sources or in nuclear instrumentation, but a more accurate evaluation must await completion of radiation damage tests which are in progress. Other possible uses are being investigated. Author (NSA)

**N69-38378#** Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
**ROTATIONAL ENERGY OF THE SYSTEM OF INTERACTING PARTICLES**
A. S. Davydov and G. F. Filippov 1968 19 p refs
(ITF-68-76) Avail: AEC Depository Libraries

The problem of separation of rotational motion in a system of interacting particles is considered. The conditions making it feasible are discussed. The congruence between moments of inertia determining the energy of the system rotational states and the spatial distribution of the particles for the case of four particles is ascertained. Author (NSA)

**N69-38381#** California Univ., Livermore. Lawrence Radiation Lab.
**ANALYSIS OF THE EFFECT OF EVAPORATION LOSS OF TRACER ATOMS DURING SURFACE SELF-DIFFUSION**
J. R. Wolfe and H. W. Weart (Mo. Univ., Rolla) 14 Mar. 1969 24 p refs Presented at AIME Spring Meeting, Pittsburgh, May 1969 Sponsored by AEC
(UCRL-71608; CONF-690507-1) Avail: CFSTI

The effect of radioactive tracer evaporation during surface diffusion experiments was analyzed for the (111) surface of fcc metals. The tracer evaporation flux ($J^*_E$) is compared with the more well-known parasitic tracer flux loss ($J^*_V$) into the bulk. Calculations of the ratio $J^*_E/J^*_V$ based on adatom diffusion on a Terrace-Ledge-Kink (TLK) surface, indicate that evaporation effects must be included in the analyses for several fcc metals. The proposed model and resulting theory verify several recently published experimental observations concerning surface diffusion on iron and nickel and offer a logical explanation of past difficulties with silver surface diffusion experiments using tracer methods. Author (NSA)

**N69-38390#** Illinois Univ., Urbana. Dept. of Physics.
**STAGE 3 ANNEALING OF ELECTRON IRRADIATED SILVER**
Alan Gordon Jun. 1969 172 p refs
(Contract AT(11-1)-1198)
(COO-1198-626) Avail: CFSTI

Silver specimens of nominal 99.9999% purity were irradiated at 1.6 and 3.0 MeV below 130°K. The damage production rate was found to decrease with increasing specimen purity and no evidence of linear production was found. For high-purity silver, only a single annealing peak occurs in stage 3. With it the state 3 peak, the annealing behavior is complicated. The activation energy first rises, reaching a maximum of 0.71 ± 0.02 eV, and then decreases, reaching a minimum of 0.57 ± 0.04 eV. Approximately the last 80% of state 3 follows second-order kinetics, but the earliest part of the anneal does not obey simple kinetics. In the region where second-order kinetics are obeyed, the number of jumps increases by a factor of 1000. After both 1.6- and 3.0-MeV irradiation, the activation energy and pre-exponential factor associated with divacancy migration is observed near the end of stage 3. Various annealing models and electron microscope evidence are considered. Author (NSA)

**N69-38394#** Princeton-Pennsylvania Accelerator, Princeton, N.J.
**CROSS SECTION FOR PION PROTON YIELDS LAMBDA NEUTRAL KAON STRUCTURE NEAR SIGMA THRESHOLD**
O. Van Dyck, R. Blumenthal, S. Frankel, V. Highland, J. Nagy et al
10 Jun. 1969 12 p refs
(Contract AT(30-1)-2171)
(PPAR-12) Avail: CFSTI

The cross section for the reaction $\pi^- p \rightarrow {}_\Lambda K^0$ was measured at nine beam energies from 780 to 1080 MeV, with a beam resolution of ±1%. The results indicate that a strong, narrow ($\Gamma \leq 20$ MeV) peak in the cross section lies within the energy bin centered at 893 MeV. Author (NSA)

**N69-38399#** Stanford Linear Accelerator Center, Calif.
**CIRCE: A GENERAL MULTI-PRONG FITTING COMPUTER PROGRAM FOR SPATIAL COORDINATES IN A NON-UNIFORM MAGNETIC FIELD**
Dietrich E. Fries Mar. 1969 30 p refs
(Contract AT(04-3)-515)
(SLAC-99) Avail: CFSTI

The computer program CIRCE, developed to perform a nonlinear least square fit for optimization of particle trajectories in a nonuniform magnetic field in bubble and spark chambers, is described. NSA

**N69-38403*#** Volt Technical Corp., Washington, D.C.
**DOUBLE CHARGE EXCHANGE OF 50 – 176 MeV NEGATIVE PIONS IN PHOTOEMULSION [DVOYNAYA PEREZARYADKA NEGATIVE PION-MEJONOV S ENERGIYEY 50 – 176 MeV V FOTOEMULSII]**
Yu. A. Batusov et al Greenbelt, Md. NASA Goddard Space Flight Center 29 Mar. 1967 4 p refs Transl. into ENGLISH from Yadern. Fiz. (Moscow), v. 5, no. 2, 1967 p 354 – 356
(Contract NASS-12487)
(NASA-CR-105977; ST-NP-10-683) Avail: CFSTI CSCL 20H

Pellicle stacks were irradiated in beams of $\pi^-$ mesons and the total double charge exchange cross sections for the mesons in photoemulsion nuclei were measured for eight values in the region 50 – 176 MeV. Author

N69-38408# Oak Ridge National Lab., Tenn.
**HIGH NUCLEAR CASCADES: A PROPOSED APPROACH TO COMPUTER SIMULATION**
N. B. Gove, H. W. Bertini, M. Feliciano, and A. H. Culkowski [1969] 48 p Sponsored by AEC
(ORNL-TM-2627) Avail: CFSTI

A computer program is proposed to calculate what happens when a high (up to 200 GeV) energy particle strikes a nucleus. The nucleus is first divided into a number of regions. To each region is assigned a density. From the densities and the known cross sections for nucleon reactions, the absorption coefficients are calculated. From the absorption coefficients the distribution function for collision sites is obtained and an event is chosen by a sampling procedure. Meson production is included as a possible event. The developing cascade is followed in discrete time steps. Nuclear matter is conserved by reducing the density in a region which has contributed a particle to the cascade. This leads to a density imbalance which is assumed to cause a flow of nuclear matter into the depleted region. Author (NSA)

N69-38411# Max-Planck-Institut fur Metallforschung, Stuttgart (West Germany). Institut fuer Sondermetalle.
**NEUTRON DIFFRACTION STUDIES ON BINARY AND TERNARY PHASES OF THE SYSTEMS TI-C-H, ZR-C-H, TI-N-H, ZR-N-H, TI-O-H, AND ZR-O-H [NEUTRONENBEUGUNGSUNTERSUCHUNGEN AN BINAEREN UND TERNAEREN PHASEN DER SYSTEM TI-C-H, ZR-C-H, TI-N-H, ZR-N-H, TI-O-H UND ZR-O-H]**
H. Goretzki Dec. 1968 66 p refs In GERMAN
(BMwF-FBK-68-62) Avail: AEC Depository Libraries

Ordering states were established by neutron diffraction studies in the ternary systems Ti-C-H, Zr-C-H, Ti-N-H, Zr-N-H, Ti-O-H and Zr-O-H which are based on nonstatistical distribution of the metalloid atoms. The structure of the ternary carbohydrides $Ti_2CH_2$ and $Zr_2CH_2$ was determined. The hydrogen atoms occupy the tetrahederal interstitial sites which are farthest from the carbon atoms. In the range of the nonstoichiometric carbides $TiC_{1-x}$ and $ZrC_{1-x}$ fcc ordered phases were found. The nonoccupied octahedral voids are enlarged by distortion of the metal atoms. Additionally soluted hydrogen occupies the free carbon positions. Based on these results the bonding models of the hard metals were discussed and compared with the physical properties of these solids. Author (NSA)

N69-38412# European Organization for Nuclear Research, Geneva (Switzerland).
**PARTICLE INJECTION SYSTEM OF THE 70 GeV PROTON SYNCHROTRON OF IFVE [SYSTEME D'INJECTION DES PARTICULES DU SYNCHROTRON A PROTONS DE 70 GeV D'L'IFVE]**
S. N. Bolko et al Feb. 1969 38 p refs Transl. into FRENCH from Gosudarstvennyi Kom. po Ispol'z. Atomnoi Energii SSSR, Serpukhov report no. IFVE-SKU-68-48-K In FRENCH
(CERN-Trans-69-8; IFVE-SKU-68-48-K) Avail: AEC Depository Libraries

The problems connected with the design and adjustment of the injection system of the 70 GeV proton synchrotron are discussed. Some considerations connected with injection of the beam into the accelerator, demands to the system characteristics, and the results of the adjustment and work with the beam are given. Author (NSA)

N69-38415# Office of Atomic Energy for Peace, Bangkok (Thailand).
**SOME EXPERIENCES IN NEUTRON DOSIMETRY**
Vichai Hayodom, Wunlop Boonkong, Sakow Mahapanyawong, and Chavee Chaimonkon 1969 10 p
(THAI-AEC-23) Avail: AEC Depository Libraries

Neutron dosimetry equipment and methods, mainly foil activation techniques, are discussed. Cross sections and resonance integrals for various foils are presented, and flux density and dose measurement techniques are described. NSA

N69-38417# Institutt for Atomenergi, Kjeller (Norway).
**RAPID DETERMINATION OF ALUMINUM IN ROCKS BY REACTOR NEUTRON ACTIVATION ANALYSIS**
E. Steinnes Jan. 1969 9 p refs
(KR-131) Avail: AEC Depository Libraries

A simple and rapid method for determination of aluminum in silicate rocks by reactor neutron activation and gamma spectrometry is presented. The method was tested on some standard rocks, and the results are in agreement with previous values obtained by the conventional gravimetric method, except for samples very low in Al, where the neutron activation results are lower. For samples with about 15% $Al_2O_3$, the precision is of the order 1 to 1.5%, and the accuracy of the mean values about 1%. Corrections must be applied for interference from silicon and manganese. Author (NSA)

N69-38419# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
**USE OF A PULSED ELECTRIC FIELD FOR THE DISCRIMINATION OF IONIZING PARTICLES RECORDED IN A NUCLEAR EMULSION [L'EMPLOI DU CHAMP ELECTRIQUE PULSE POUR LA DISCRIMINATION DES PARTICULES IONISANTES ENREGISTREES DANS L'EMULSION NUCLEAIRE]**
V. Labau 1968 10 p refs In FRENCH
(IFA-PN-21) Avail: AEC Depository Libraries

The use of a pulsed electric field for discriminating ionizing particles recorded in a nuclear emulsion is described for the study of nuclear reactions with certain light elements such as lithium and boron bombarded by thermal neutrons. NSA

N69-38421# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
**ON THE SPACE-TIME DESCRIPTION OF HADRONS, PART 1**
G. Domokos, S. Kovesi-Domokos, and F. Mansouri 11 Jan. 1969 52 p refs
(Contract AT(30-1)-4076)
(NYO-4067-1) Avail: CFSTI

The possibility of describing the interactions of composite Reggeized hadrons in space-time is investigated. A formalism is constructed giving a unified description of the spin states of composite hadrons. A Lorentz family of hadron Regge trajectories allows the introduction of local hadron amplitudes. Investigation of the covariance properties of the local hadron amplitudes with respect to proper complex Lorentz transformations, space and time inversion, charge conjugation and gauge transformations establishes the principles according to which observed families of hadron states are described in terms of representations of the complex Lorentz group. A manifestly Lorentz covariant description of the propagation of composite hadrons is given. Explicit expressions of the composite hadron propagators are given for chiral singlet mesons and chiral doublet fermions. Author (NSA)

N69-38422# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
**ON THE SPACE-TIME DESCRIPTION OF HADRONS, PART 2**
G. Domokos, S. Kovesi-Domokos, and F. Mansouri 16 Jan. 1969 44 p refs
(Contract AT(30-1)-4076)
(NYO-4067-2) Avail: CFSTI

Interactions of composite (Reggeized) hadrons are investigated. A scheme is given for writing down trilinear vertices between hadrons consistent with Lorentz invariance. The vertices become local when the hadrons involved are put on their mass shells (physical points of the trajectories). A graphical method, similar to

Feynman diagrams, is developed for writing down scattering amplitudes involving composite hadrons. The procedure for constructing scattering amplitudes is stated in terms of a few rules. The example of elastic scattering of spinless particles with the exchange of a single Lorentz pole is briefly discussed; it is shown that the diagram rules lead to the well-known expression for a scattering amplitude with rapidly decreasing residues. Author (NSA)

**N69-38430#** Mathematical Applications Group, Inc., White Plains, N.Y.

**A DESCRIPTION OF THE PAWN SYSTEM FOR THE MONTE CARLO ADJOINT CALCULATION OF SECONDARY GAMMA DOSE AS A FUNCTION OF TIME** Final Report

W. Guber, M. H. Kalos, and H. A. Steinberg Mar. 1969 94 p refs

(Contract DASA01-68-C-0115)

(AD-690101; MR-6905; DASA-2290) Avail: CFSTI CSCL 18/8

The photon adjoint with neutron system (pawn) is a program designed to compute secondary gamma ray dose at one or more point detectors. The neutron source can be one or more points or else distributed in volume. Data is obtained as a function of time from neutron birth to gamma/dection. Author (TAB)

**N69-38437#** Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

**A REVISED PHOTON PROBABILITY LIBRARY FOR USE WITH ISOSHLD-III**

C. A. Mansius Apr. 1969 31 p refs

(Contract AT(45-1)-1830)

(BNWL-236(Suppl-2)) Avail: CFSTI

An updated photon probability library containing data for 499 isotopes was compiled for use with ISOSHLD. All isotopes in the library were tagged to indicate the reliability of the tabulated photon values. Although data for short half-life isotopes are limited, this fact is shown to be unimportant for most applications of ISOSHLD. The photon library format was revised to accommodate any number of photons for each isotope. ISOSHLD was changed to accept the new expanded library, to conserve source energy rather than number of source photons, and to print out the transformed spectra by isotope. A second RIBD library was added for fast reactor fission-product inventory calculations. Author (NSA)

**N69-38438#** European Organization for Nuclear Research, Geneva (Switzerland).

**FOCUSING OF RINGS OF CHARGED ELECTRONS IN THE COLLECTIVE ACCELERATOR**

A. G. Bonch-Osmolovskii et al Feb. 1969 11 p refs Transl. into FRENCH from Russian Report No. JINR-P9-4135 In FRENCH

(CERN-Trans-69-8; JINR-P9-4135) Avail: AEC Depository Libraries

Problems of charged electron ring focusing in the collective ion linear accelerator are discussed. Three types of focusing are considered: focusing of the azimuthal component of the magnetic field, focusing by counter waves and focusing by the image forces. The conditions of the stability of the electron oscillations in the ring are obtained and the possibilities of applying the above-mentioned types of focusing are determined. Author (NSA)

**N69-38447#** Institutt for Atomenergi, Kjeller (Norway).

**MAGNETISM IN METALS AND ALLOYS: ADVANCED COURSE ORGANIZED BY THE NETHERLANDS'-NORWEGIAN REACTOR SCHOOL, 16-20 SEPTEMBER 1968**

Sep. 1968 277 p refs

(KR-132) Avail: AEC Depository Libraries

Fifteen lectures by different authors are included on the following topics: electron theory of magnetic metals, positron annihilation, neutron diffraction studies of 3d metals and alloys, polarized neutron scattering and analysis, magnetic susceptibility measurements and their interpretation, structure of rare earth metals and alloys, hyperfine interactions and magnetization from nuclear specific heats and Moessbauer effect, NMR in transition metals, and spin density and magnetic scattering in 3d metals. Author (NSA)

**N69-38448#** Institute of Nuclear Research, Warsaw (Poland).

**RADIATION QUALITY FACTOR (QF) DEPTH DISTRIBUTION DETERMINATION IN TISSUE LIKE PHANTOM FOR THERMAL NEUTRONS**

Stanislaw Pszona 1968 12 p refs Presented at the 1st European Congr. on Radiation Protect., Menton, France, 1968

(INR-P-965) Avail: AEC Depository Libraries

The paper describes a method for quality factor determination in mixed radiation field. The method is based on a tissue equivalent ionization chamber and on a scintillation counter with NE102A scintillator. The performance of such double detector system in thermal neutron field has been analyzed. The quality factor (QF) dependence as a function of depth of phantom (tissue like) in thermal neutron radiation has been determined. The results of measurements and discussion are presented in the paper. Author (NSA)

**N69-38450#** United Kingdom Atomic Energy Authority, Culham (England). Translations Office.

**IONIZATION BY ULTRAVIOLET RADIATION EMITTED FROM A LASER PRODUCED PLASMA**

T. U. Arifov et al Apr. 1969 10 p refs Transl. into ENGLISH from Zh. Eksperim. i Teor. Fiz. (Moscow), v. 56, no. 2, 1969 p 516-521

(NP-TR-1790; CTO-609) Avail: CFSTI

It is shown that even for moderate laser powers the ultraviolet radiation can, with a high degree of probability, ionize the atoms and molecules of a gas, especially near the focus. This opens up new prospects for producing highly ionized plasmas by bombarding a pellet, target or gas with a laser. Microwaves, probes, and a luminophor have been used as diagnostic means for investigating the ultraviolet radiation and the ionization produced. Experiments are described on the focusing of the uv radiation by polished metallic mirrors. It is shown that these can be used to produce regions of intense radiation. The results are applicable not only to the production of laser plasmas but also for photodissociation, excitation of atoms, production of polarized electrons from polarized atoms, and in various experiments, to study the effect of concentrated ultraviolet radiation on matter and organisms. Author (NSA)

**N69-38451#** Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.

**PRODUCTION OF CARRIER-FREE RADIOISOTOPES FROM TARGETS IRRADIATED WITH DEUTERONS OR ALPHA PARTICLES IN THE U-120 CRACOW CYCLOTRON. PART 1: PREPARATION OF RADIOISOTOPES OF CADMIUM, INDIUM, AND TELLURIUM**

S. Kopta, H. Niewodniczanski, T. Petryna, and I. Stronski Nov. 1968 16 p refs

(INP-862) Avail: AEC Depository Libraries

The results of experiments on the preparation of carrier-free radioisotopes from targets irradiated in a U-120 cyclotron are presented. In the Ag(d,2n), Ag($\alpha$,xn), and Sn($\alpha$,xn) reactions the isotopes $^{109}$Cd, $^{109}$In, $^{110m}$In, $^{111}$In, $^{119}$Te, $^{119m}$Te, $^{121}$Te and $^{121m}$Te were prepared by means of ion exchange, extraction, and precipitation methods. Author (NSA)

**N69-38452#** Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.

**PRODUCTION OF CARRIER-FREE RADIOISOTOPES FROM TARGETS IRRADIATED WITH DEUTERONS OR ALPHA PARTICLES IN THE U-120 CRACOW CYCLOTRON. PART 2: PREPARATION OF RADIOISOTOPES OF GADOLINIUM, SAMARIUM, AND THULIUM FROM TARGETS OF**

**SAMARIUM, NEODYNIUM, AND HOLMIUM**
S. Kopta, H. Niewodniczanski, T. Petryna, and I. Stronski Nov. 1968 18 p refs
(INP-663) Avail: AEC Depository Libraries

The results of experiments on the preparation of carrier-free radioisotopes of lanthanides from targets irradiated in a U-120 cyclotron are presented. In the Sm(α,2n), Nd(α,n), and Ho(α,2n) reactions the isotopes $^{149}$Gd, $^{153}$Sm, and $^{167}$Tm were obtained. They were prepared by means of ion exchange and extraction chromatography methods. Author (NSA)

N69-38458# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
**INVESTIGATION OF CHANNELS OF THE REACTION NEGATIVE PION PLUS p YIELDS n PLUS POSITIVE PION PLUS NEGATIVE PION PLUS m NEUTRAL PION AT pc EQUALS 4 GeV**
V. G. Grishin, M. Iresh, D. K. Kopylova et al 1969 27 p refs In RUSSIAN
(JINR-P1-4412) Avail: AEC Depository Libraries

The reaction $\pi^- + p \rightarrow n + \pi^+ + \pi^- + m\pi^0$ (1) was studied using a 24-liter propane bubble chamber of the Laboratory of High Energies, JINR at an incident $\pi^-$-meson momentum p = 4 GeV/c. There were 150,000 pictures scanned and 2,374 events observed. The cross sections of channels in the reaction (1) are $\sigma(\pi^- p \rightarrow n\pi^+\pi^-\pi^0) = (2.5 \pm 0.7)$mb, $\sigma(\pi^- p \rightarrow n\pi^+\pi^-2\pi^0) = (1.6 \pm 0.5)$mb, $\sigma(\pi^- p \rightarrow n\pi^+\pi^-3\pi^0) = (0.5 \pm 0.2)$mb, $\sigma(\pi^- p \rightarrow n\omega\pi^0) = (0.8 \pm 0.2)$mb. The momentum and angular distributions of $\pi^+$-mesons in c.m.s. are represented. Author (NSA)

N69-38459# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
**MEASUREMENT OF THE REAL PART OF THE ELASTIC pi-p SCATTERING AMPLITUDE IN THE COULOMB INTERFERENCE REGION BY USING THE FILMLESS SPARK CHAMBER SPECTROMETER ON LINE TO COMPUTER**
G. G. Vorobev, N. N. Govorun, I. A. Golutvin et al 1969 24 p refs In RUSSIAN
(JINR-P1-4445) Avail: AEC Depository Libraries

New data on the check of dispersion relations are given, which are obtained from the analysis of the elastic π-p scattering angular distribution in the Coulomb interference region. A new technique on line to computer was used for measurements. Necessary statistical material was accumulated due to development and application of a new system of selective triggering based on the principle of detection of scattering acts according to the change in the direction of cone axis of the Cherenkov radiation. Author (NSA)

N69-38461# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
**EMPIRICAL DEPENDENCE-RANGE-ENERGY-FOR 100 - 100000 MeV PROTONS**
I. K. Vzorov 1969 3 p refs In RUSSIAN
(JINR-P1-4442) Avail: AEC Depository Libraries

Empirical relations between the range and the energy of protons are given which are valid for the energy region 100 - 100,000 MeV. These relations are $R = a(\ln T)^b$, $T = (c)^{R/b}$, where a, b and c are the parameters depending on the atomic number of the stopping material. Author (NSA)

N69-38467# Oak Ridge National Lab., Tenn. Neutron Physics Div.
**EXAMINATION OF SEVERAL CALCULATIONAL MODELS FOR USE IN COMPUTING GAMMA-RAY PENETRATION**
Hisao Yamakoshi 7 Mar. 1969 119 p refs Sponsored by AEC
(ORNL-TM-2520) Avail: CFSTI

Two analytical models for treating multiple scattering of gamma radiation are utilized to predict the penetration of slabs for a slant incident monoenergetic, monodirectional source incident on lead and polyethylene slabs. Monte Carlo calculations were also performed to check the validity of these two models and to give data for the construction of response functions for transmitted dose. The first model, the so-called "extended single scattering" model treats the effect of multiple scatterings beyond the first within a barrier by applying a buildup factor to the first scatter taken to be a source. The second model is based on the idea of the successive collision model and formulations of transmitted dose and spectra for up to triple scatterings are derived. Comparison between the second model and the Monte Carlo results shows fairly good agreement. Author (NSA)

N69-38473# Institute of Nuclear Research, Warsaw (Poland).
**CROSS-SECTIONS FOR THE MESON - BARYON TWO-BODY REACTIONS AND THE QUARK MODEL**
T. Hofmokl and M. Szeptycka 1968 14 p refs
(INR-1040) Avail: AEC Depository Libraries

A comparison is presented of the predictions of the quark model with the existing experimental data for the production of pseudoscalar and vector mesons in two-body reactions with charge exchange but no strangeness exchange. Author (NSA)

N69-38474# Institute of Nuclear Research, Warsaw (Poland).
**RELATION OF THE MUON NUMBER ON THE SIZE OF THE EAS**
J. Gawin and J. Hibner 1968 12 p refs
(INR-1009) Avail: AEC Depository Libraries

According to the model of EAS development assumed in the behavior of the α-exponent in the commonly accepted relation $\bar{N}_\mu \approx \bar{N}^{\alpha}_{e}$ depends strongly on the mass composition of the primary cosmic radiation at very high energies: it is constant for the unmodulated composition but changes its value distinctly for the modulated composition. The analysis of the experimental data of the Lodz, Moscow and Haverah Park groups shows a certain variation of α, but it is too early to assert that this variation agrees satisfactorily with the calculated one. With more exact results and more adequate representation of the experimental data, it will be possible to confirm (or deny) the adumbrated trend in favor of the assumption of the modulated composition. Author (NSA)

N69-38480# Brookhaven National Lab., Upton, N.Y. Information Div.
**WAVE DIFFRACTION IN THE PRESENCE OF SOME REFRACTIVE INDICES**
V. G. Baryshevskii et al May 1969 9 p refs Transl. into ENGLISH of Russian Report JINR-P4-4202
(BNL-TR-272; JINR-P4-4202) Avail: CFSTI

Neutron and γ-quantum diffraction in a medium having some refraction indices is considered. It is shown that the account of the change in the radiation wavelength leads to the possible appearance of polarization in the initial nonpolarized neutron beam as a consequence of the pure magnetic diffraction reflection. The influence of the diffraction effects on the electron and cyclotron resonances in the crystals with the polarized nuclei is pointed out. Author (NSA)

N69-38481# Columbia Univ., Irvington, N.Y. Nevis Labs.
**CHARGE ASYMMETRY IN K SUB e3 DECAY**
Harry J. Saal (Ph.D. Thesis) Apr. 1969 87 p refs
(Contract AT(30-1)-1932)
(NEVIS-169; CU-273; R-863) Avail: CFSTI

The charge asymmetry in $K_{e3}$ decay was measured and found to be $(2.46 \pm 0.59) \times 10^{-3}$ where positron production is favored in the decay. Nonnegligible corrections were applied due to $e^+$ annihilation and pion interaction phenomena in the ≈0.7 gm/cm$^2$ of matter in the apparatus. No clear conclusion may be drawn from phenomenological models of CP violation in K-decay because of the unsettled nature of the experimental situation. The μ-e universality appears to be maintained in the CP-violating decay of $K^0_L$. Author (NSA)

**N69-38482#** Arizona Univ., Tucson. Dept. of Chemistry.
**DETERMINING THE EFFECT OF STRUCTURE AND ENVIRONMENT ON THE RADIATION AND NON-RADIATION PROBABILITIES IN METAL COMPLEXES Annual Technical Progress Report, 16 Jun. 1968 - 15 Jun. 1969**
15 Jun. 1969 10 p refs
(Contract AT(11-1)-773)
(COO-773-19) Avail: CFSTI

Relaxation of $^2E$ states in Cr(III) complexes, the effect of host lattice on ground-stage splittings in chromium complexes, low-temperature spectra, $^2E$ splitting in tetragonal fields, doublet - doublet absorption from excited states, and polarization of electronic transitions are discussed. NSA

**N69-38483#** Leiden Univ. (Netherlands).
**THE INTERACTION OF MOLECULES WITH LOW-ENERGY (0 TO 30 eV) ELECTRONS**
Hidde Harman Brongersma (Ph.D. Thesis) 1968 90 p refs
(NP-17938) Avail: AEC Depository Libraries

Electronic transitions induced by impact of low energy electrons on a variety of atoms and molecules were studied. A spectrometer particularly suitable for the study of threshold excitations is described. Results are presented and discussed for nitrogen, carbon monoxide, ammonia, saturated hydrocarbons, olefins, molecules containing the carbonyl group, conjugated hydrocarbons, and organic nitrogen compounds. A striking feature of these results is the importance of singlet - triplet and other optically forbidden transitions. Total cross sections for given excitation processes in He, CO, $N_2$, $O_2$, $CO_2$, ethylene, and benzene were measured. Author (NSA)

**N69-38492#** California Univ., Berkeley. Lawrence Radiation Lab.
**EVALUATION OF SCATTERED DOSE RATE BY SINGLE COMPTON SCATTERING**
Donald L. Rising 6 Mar. 1969 15 p refs
(Contract W-7405-ENG-48)
(UCRL-18801) Avail: CFSTI

A method of calculating the photon flux and dose rate from scattered gamma rays, based on single Compton scattering theory, is presented. This method is more limited in application than the use of Monte Carlo programs, but is simpler and requires less computing time. It is particularly suited to the scattering of medium-energy $\gamma$ rays by air in irradiators using $^{60}Co$ or other isotopes. The calculations show that the solutions are volume integrals over the scattering medium which can be evaluated by numerical integration. An example of a particular irradiator is given, together with the program used to evaluate the integrals and some typical input and output. Author (NSA)

**N69-38504#** Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
**STRONG PROCESSES WITH THE PRODUCTION OF SOME PARTICLES BELONGING TO ONE ISOTOPIC MULTIPLET**
O. V. Dumbrais and M. I. Podgoretskii 1969 22 p refs In RUSSIAN
(JINR-P2-4473) Avail: CFSTI

Strong processes are analyzed in which some finite particles belonging to one isotopic multiplet are produced. The relations were obtained between the reaction cross sections for configurations which differ from each other by momentum interchange of particles considered. Corresponding modification of the Shmushkevich method was described. Author (NSA)

**N69-38505#** Brookhaven National Lab., Upton, N.Y.
**RADIONUCLIDE GENERATORS: PAST, PRESENT, AND FUTURE**
L. G. Stang, Jr. 22 Apr. 1969 151 p refs Presented at the 3d Ann. Nucl. Med. Meeting Puebla, Mex.
(BNL-13595; CONF-690413-1) Avail: CFSTI

Radioisotope generator systems are described. When a radioisotope undergoes radioactive decay the product may be a stable isotope in some cases or another radionuclide in another. The second radionuclide on decay can form either a stable nuclide or a third radionuclide. The chain is ultimately terminated by a stable isotope. There are presently 72 possible practical systems. New production methods and more chains are being realized currently. It is hoped that the medical personnel would ask specifically for the needed isotopic property and that the isotope can be provided. Seventy-two of the practical radioisotopic systems are listed. Information of the characteristics of a parent-daughter relationship is given. NSA

**N69-38516#** Gulf General Atomic, San Diego, Calif.
**APPLICATION OF PHOTOINDUCED REACTIONS TO NUCLEAR MATERIALS SAFEGUARDS PROBLEMS Quarterly Progress Report, 1 Jan. - 31 Mar. 1969**
R. L. Bramblett, T. Gozani, R. O. Ginaven, L. A. Kull, J. I. Mc Millan et al 21 Apr. 1969 28 p refs
(Contract AT(04-3)-167)
(GA-9331) Avail: CFSTI

Using a CDC 1700 on-line computer, fission product gamma data were taken as a function of time after irradiation with bremsstrahlung. These gamma spectra will be used to identify fission products. A simple and sufficiently intense source of subthreshold neutrons can be obtained from the $(\gamma,D)$ reaction on $D_2O$. These neutrons were used to determine $^{235}U$ and $^{238}U$ in samples. Uranium oxide samples were analyzed for $^{235}U$ by a passive scan method. The prompt detection of neutrons produced by an electron linear accelerator is hampered by the strong gamma flash that paralyzes the neutron counting system for some time following the beam pulse. A reduction in this effect was successfully attempted with a small fission chamber and a bank of large $BF_3$ counters. The method is based on the removal of coherent signals. The FITT code was developed to meet the requirements of nuclear materials assays. The performances of an accelerator section and injector for the Prototype Assay LINAC (PAL) were calculated. NSA

**N69-38521#** Brookhaven National Lab., Upton, N.Y.
**THE ANALYSIS OF 28.5 GeV/c pp INTERACTIONS PRODUCING 6 OR MORE CHARGED PARTICLES**
P. L. Connolly, I. R. Kenyon, R. R. Kinsey, and A. M. Thorndike 21 May 1969 29 p refs Presented at the Intern. Conf. on Elementary Particles, Lund, Sweden
(BNL-13694; Conf-690608-3) Avail: CFSTI

A study is made of the production mechanisms for the reaction $p + p \rightarrow p + p + 2\pi^+ + 2\pi^-$ at 28.5 GeV/c in a hydrogen bubble chamber. The $\Delta(1236)$ and the $\rho(760)$ are produced strongly. Also enhancements suggest the production of the isobars $N^*(1520)$ and $N^*(1690)$. The multiperipheral model and the bremsstrahlung model are used to interpret the data. NSA

**N69-38522#** California Univ., Berkeley. Lawrence Radiation Lab.
**POSITIVE PION ENERGY SPECTRUM IN POSITIVE KAON YIELDS NEUTRAL PION PLUS POSITIVE MUON PLUS NEUTRINO. SEARCH FOR DIRECT RADIATION IN POSITIVE KAON YIELDS POSITIVE PION PLUS NEUTRAL PION PLUS GAMMA**
Peter Klaus Kijewski Jun. 1969 100 p refs
(Contract W-7405-eng-48)
(UCRL-18433) Avail: CFSTI

An analysis was made of 2041 events of the type $K^+ \rightarrow \pi^0 \mu^+ \nu$ to gain some understanding about the matrix element of the strangeness changing hadron current. In this experiment this current describes the transition $K^+ \rightarrow \pi^0$. The most general matrix element is written in terms of two Lorentz scalars called form factors. The events for this analysis were obtained from a spark chamber experiment at the Berkeley Bevatron. Both converted $\gamma$-rays from the $\pi^0$ were observed and the kinematics of each event are completely reconstructed. This allows the $\pi^0$ energy distribution to be determined which is used to get information about the form

factors $f_+$ and $f_-$. The slope of the $\pi^0$ energy spectrum is sensitive to the ratio $\xi(0) = f_-(0)/f_+(0)$. Assuming that $f_+$ and $f_-$ are independent of $q^2$, the result $\xi(0) = 0.3 \pm 0.3$ is obtained from a measurement of the slope. A $q^2$ dependence of $f$ is introduced by means of a linear approximation. Author (NSA)

**N69-38529#** Bonn Univ. (West Germany).
**ANALYSIS OF THE PHOTOPRODUCTION OF NEUTRAL PIONS ON PROTONS IN THE ENERGY RANGE E(SUB GAMMA) LESS THAN OR EQUAL TO 1200 MeV**
Walter Pfeil 1968 181 p refs In GERMAN
(NP-17842) Avail: AEC Depository Libraries

An analysis of the measured cross section for $\pi^0$ production on protons is carried out, using the isobar model. The results are compared with the corresponding analysis of $\pi^+$ production. The invariant amplitudes $A_i(s,t,u)$, which are calculated with help of the on-mass-shell propagator in the Rarita–Schwinger formalism, are approximated using a pole approximation. Under consideration of the Born approximation, the elementary $\rho$– $\omega$ exchange, and the selected nucleon resonances $P_{33}$ (1230), $D_{13}$ (1530), $F_{15}$ (1690), $P_{33}$ (1485), $D_{15}$ (1714), $S_{31}$ (1688), and $S_{31}$ (1710), a good description of the data is possible up to $E\gamma = 1.2$ GeV. The half width $\Gamma_{N\pi}$– $N\gamma$ was calculated from the coupling constant. The ratio of the transition magnetic moment $\mu_T$ of the $P_{33}$ resonance to the SU(6) value $(U_T)_{SU(6)}$ was found to be $1.37 \pm 0.14$. It is concluded that the isobar approximation, which avoids an exact theoretical basis, yields a good parametrization of the photoproduction. Author (NSA)

**N69-38533#** Pennsylvania Univ., Philadelphia.
**PRODUCTION OF OMEGA-MESON IN THE REACTION PROTON PLUS DEUTERON YIELDS HELIUM-3 PLUS OMEGA-MESON USING A NOVEL MISSING-MASS SPECTROMETER**
H. Brody, E. Groves, R. VanBerg, W. Wales, B. Maglic et al May 1969 11 p refs
(Contract AT(30-1)-2171)
(NYO-2171-275) Avail: CFSTI

Preliminary data from the $p + d \rightarrow {}^3He + x^0$ interaction at a proton energy of 3 GeV is presented. A clear $\omega$ peak is shown above a smooth background. A new style missing-mass spectrometer is used for detecting the recoil helium-3. NSA

**N69-38534#** Scientific Translation Service, Ann Arbor, Mich.
**ESTIMATE OF STRESSES IN THE COATING OF COMPRESSED COATED PARTICLES**
W. Delle et al 1969 26 p refs Transl. into ENGLISH from German Document Sponsored by AEC Prepared for ORNL
(ORNL-tr-2128; JUL-569-RW) Avail: CFSTI

The state of stress in the outer layers of a coated particle which is compressed between two planes can be calculated with the theory of elastic shells. Among other things, this permits the derivation of a formula for the determination of the rupture stress from the rupture load and the geometrical dimensions of a particle. Experiments with particles with pyrolytic carbon coatings which were analyzed according to this relation show a good agreement with the results of tensile tests with pyrolytic carbon disks. Author (NSA)

**N69-38535#** Argonne National Lab., Ill.
**DIFFUSION OF RADIOACTIVE DECAY PRODUCTS IN MONAZITES**
S. N. Voronovskii et al 1969 14 p refs Transl. into ENGLISH from Geokhimiya (USSR), no. 2, 1969 p 185–190
(ANL-Trans-748) Avail: CFSTI

Experimental data for diffusion coefficients and activation energy of lead and helium isotopes in monazites from the Ukraine and Ceylon were obtained. Pyrochemical method of lead sublimation in the vacuum was used for lead separation. Its isotopic composition and quantitative content were determined mass-spectrometrically by the method of isotope dilution. The helium content was determined mass-spectrometrically by the internal standard method. It was found that practically all the lead is firmly bound in the crystal lattice of monazite. In regard to helium, the stable portion of the sample from the Ukraine was 10%, from Ceylon 38%. Author (NSA)

**N69-38537#** California Inst. of Tech., Pasadena. Arthur A. Noyes Lab. of Chemical Physics.
**CROSS SECTIONS FOR EXCITATION OF THE 2 SUP 2 S STATE OF HYDROGEN BY ELECTRON IMPACT**
D. G. Truhlar and A. Kuppermann [1968] 10 p refs Presented at the 6th Intern. Conf. on the Phys. of Electron and Atomic Collisions, Cambridge, Mass.
(Contract AT(04-3)-767)
(CALT-767-P-4-45; CONF-690702-2) Avail: CFSTI

Several different theories and approximations were used to calculate integral and differential cross sections for the 1s–2s transition in hydrogen excited by electron impact. The results of the various calculations are compared with each other, with other calculations, and with experiment in figures and tables. NSA

**N69-38542#** Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
**REMARK ON THE FORM FACTOR IN THE FERMI QUARK MODEL**
R. F. Mayer Apr. 1969 5 p refs
(DESY-69/17) Avail: AEC Depository Libraries

It is shown that there are no difficulties in getting a nucleon form factor without zeros from an antisymmetric quark wave function. An example which fits the data very well is given. Author (NSA)

**N69-38543#** Atomic Weapons Research Establishment, Aldermaston (England).
**NEUTRONS SCATTERING BY U 235 AND Pu 239 FOR INCIDENT NEUTRONS OF 2, 3 and 4 MeV**
R. Batchelor and K. Wyld Aug. 1969 16 p refs
(AWRE-0-55/69; C-17) Copyright. Avail: HMSO: 2s 6d

The secondary neutron spectra resulting from the fast neutron bombardment of $U^{238}$ and $Pu^{239}$ have been measured as a function of angle for 2, 3 and 4 MeV incident energies, using a time of flight spectrometer. The spectra have been analyzed on an absolute basis for the elastic, and inelastic scattering, and fission components. The 2 MeV runs show slight evidence that the fission component is harder than anticipated. Author

**N69-38552#** Technische Hochschule Munchen (West Germany). Institut fuer Radiochemie.
**SPECIAL EQUIPMENT OF THE INSTITUTE FOR RADIOCHEMISTRY OF TECHNISCHE HOCHSCHULE MUENCHEN. PART 1. HOT LABORATORY**
K. Lorenzen Dec. 1968 23 p refs In GERMAN
(BMwF-FBK-68-67) Avail: AEC Depository Libraries

The Institute for Radiochemistry at the "Technische Hochschule München" was equipped with a "hot laboratory," constructed during 1962 to 1965, for working with highly radioactive materials. Subsequently, special equipment for investigating these materials was installed. The design and construction of the hot laboratory, including the special equipment are discussed. Author (NSA)

**N69-38558#** Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
**ACCURATE CALCULATION OF RADIATION LENGTHS**
T. M. Knasel (MIT, Cambridge) Feb. 1969 13 p refs
(DESY-69/9) Avail: AEC Depository Libraries

Using recent precise calculations of the total cross section for pair production, values for the radiation lengths of elements Z

= 2, 6, 13, 29, and 82 are given to an accuracy of 0.1%, and for Z = 1, to an accuracy of 0.5%. In addition, a formula is given which predicts the radiation length for any other element $Z \geq 6$ to 1%. The present values represent an improvement over commonly used tables because of the precision of the present prediction, the knowledge of its uncertainty, as well as the extended range of elements included. Author (NSA)

**N69-38564*#** Ali (Dolores E.), Berkeley, Calif.
**MEASUREMENTS OF NEGATIVE ION PRODUCTION IN ATMOSPHERIC GASES**
Dolores E. Ali Washington NASA Oct. 1969 42 p refs
(Contract NAS2-5209)
(NASA-CR-1406) Avail: CFSTI CSCL 20H

Two electron capture by $H^+$ and $He^+$ in collisions with various gases was investigated. The method used to measure effective cross sections for the charge changing reactions allows direct determination of the energy defects. Preliminary cross sections were obtained for two electron capture by $H^+$ at 0.28 keV and for $H^+$ and $He^+$ at 2 keV. In addition, negative ions formed by electron bombardment of gases in the ion source were mass analyzed. The charge exchange gases used in the cross section measurements were $H_2$, $N_2$, $O_2$, Kr, and Xe for $H^+$ at 2 keV; Kr, He, $H_2$, $N_2$, and $O_2$ for $He^+$ at 2 keV; and $H_2$, $O_2$, and Xe for $H^+$ at 0.28 keV. The corresponding cross sections range from $10^{-19}$ to $10^{-17}$ $cm^2$ for $H^+$ at 2 keV; $10^{-23}$ to $10^{-21}$ $cm^2$ for $He^+$ at 2 keV; and $10^{-21}$ to $10^{-19}$ $cm^2$ for $H^+$ at 0.28 keV. Finally, an attempt was made to observe two electron capture by $N^+$ at 2 keV; the results were inconclusive. Author

**N69-38566#** European Organization for Nuclear Research, Geneva (Switzerland).
**METHOD OF DETERMINATION OF THE ACCELERATION REGIME OF THE IFVE PROTON SYNCHROTRON INJECTOR**
A. G. Afonin et al Feb. 1969 23 p refs Transl. into FRENCH of Russian report In FRENCH
(CERN-Trans-69-9; IFVE-INZH-68-48-K) Avail: AEC Depository Libraries

A method for defining the RF field levels and phases of the cavities is described for the 100-MeV proton linac I-100 as the injector of the accelerator of the IHEP. The zero current technique, which allowed to find the threshold of the RF field levels and phases is described. The choice of the buncher's regime and the experimental data of some parameters of the Linac I-100 are discussed. Author (NSA)

**N69-38567#** Brookhaven National Lab., Upton, N.Y. City Coll. of the City of New York. Dept. of Physics.
**FURTHER EVIDENCE FOR Y SUB 1 RESONANCE (1618) FROM 3.9 GeV/c NEGATIVE KAON-NEUTRON INTERACTIONS**
David J. Crennell, Uri Karshon, Kwan Wu Lai, John S. O'Neall, J. Michael Scarr et al 20 May 1969 19 p refs Presented at the Intern. Conf. on Elementary Particles, Lund, Sweden, 25 Jun.–1 Jul. 1969 Supported by AEC and NSF Prepared by Brookhaven Natl. Lab. and City Coll. of the City of N.Y.
(BNL-13681; A-226(b); Conf-690608-1) Avail: CFSTI

The existence of an $I = 1$ $\Lambda\pi$ resonance with mass 1618 ± 8 MeV and width 72(+22,–15) MeV is confirmed in a study of $K^-d$ interactions in the BNL 80" bubble chamber. Events from approximately 200,000 pictures were measured. Evidence for the $Y^*_1(1619)$ occurs principally in events fitting the $K^- n \rightarrow \Lambda\pi^+\pi^-$ interaction. NSA

**N69-38569#** Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
**AN UPPER LIMIT FOR THE BRANCHING RATIO GAMMA (phi MESON YIELDS NEUTRAL PION PLUS gamma/GAMMA (phi MESON YIELDS all)**
C. Bemporad, P. L. Braccini, R. Castaldi, L. Foa, K. Luebelsmeyer et al Apr. 1969 11 p refs
(DESY-69/15) Avail: AEC Depository Libraries

An experiment was performed at DESY to search for the $\pi^0 + \gamma$ decay mode of the $\phi$ mesons, photoproduced at 5.5 GeV on a Zn target. From the known production cross section and the calculated detection efficiency, an upper limit for the branching ratio of 0.35% was obtained. Author (NSA)

**N69-38578#** Sandia Corp., Albuquerque, N. Mex. Electron Beam Physics Research Div.
**A COMPUTERIZED METHOD OF PREDICTING ELECTRON BEAM BREMSSTRAHLUNG RADIATION WITH SPECIFIC APPLICATION TO HIGH VOLTAGE FLASH X-RAY MACHINES**
T. H. Martin May 1969 41 p refs Sponsored by AEC
(SC-RR-69-241) Avail: CFSTI

Many interesting phenomena occurring in the radiation output of large flash X-ray machines can be utilized only by understanding the action of the incident electron stream on the target. The detailed calculations required to understand these effects are best performed with a computer. The computer program utilized is explained, and the outputs obtained are tabulated. The report also draws conclusions for future research, analysis, and machine design. Interrelationships are developed between the switch rise time, the radiation pulse length, the dose expected at 1 meter, and the dose distribution. Author (NSA)

**N69-38579#** Central Lab. for Radiological Protection, Warsaw (Poland).
**DISTORTION TO SPECTRA AND THE EFFICIENCY OF SILICON DETECTORS FOR DIFFUSIVE INCIDENCE TO THE DETECTOR OF ELECTRONS FROM C-14 AND S-35 SOURCES**
M. Slapy, A. Dabrowski, S. Glowacki, I. Jarosiewicz, and I. Roman 1968 20 p refs
(CLOR-72) Avail: AEC Depository Libraries

The distortion to beta spectra, measured by means of silicon detectors in $2\pi$ and $4\pi$ geometry was studied for carbon-14 and sulfur-35 sources. A method of measurement of absolute efficiency of $2\pi$ counter is described, and the efficiency dependence on the discrimination level is established. Author (NSA)

**N69-38581#** Oak Ridge National Lab., Tenn. Health Physics Div.
**DISTRIBUTION OF RADIATION FROM A 14 MeV NEUTRON SOURCE IN AND NEAR STRUCTURES**
J. S. Cheka May 1969 33 p refs Sponsored by AEC
(CEX-65.13) Avail: CFSTI

The angular distribution of radiation in radiation-equivalent Japanese housing was determined. The radiation source was a 14 MeV neutron generator that utilized the $^3H(d,n)^4He$ reaction with the design capability of 500 mA of beam current and a neutron output of $\sim 10^{13}$ n/sec over a 4-hr period; it was mounted on a hoist car on a 1500 ft tower and could be positioned at elevations from 25 to 1500 ft. Measurements were made in the house with pairs of one Radsan and one GM tube on racks 3 and 5 ft above selected points. Standardization and calibration procedures are described. Measurements of both neutron and $\gamma$-ray intensity were made at selected points in the house and also at points 4 ft in front of and 4 and 14 ft behind the house with the source elevation at 1125 and 500 ft. Data are presented in graphic and tabular form. NSA

**N69-38590#** Addis Translations International, Woodside, Calif.
**REPORT OF THE WORK OF THE OPEN-CONFIGURATION COMMITTEE [RAPPORT DES TRAVAUX DE LA COMMISSION CONFIGURATIONS OUVERTES]**
J. Andreoletti et al Feb. 1969 21 p refs Transl. into ENGLISH

from EURATOM-CEA Report No. DPh-PFC/Note-1025 Sponsored by AEC Prepared for Calif. Univ., Livermore. Lawrence Radiation Lab.
(UCRL-Trans-10347; DPh-PFC/NOTE-1025) Avail: CFSTI

The areas considered by the committee are: (1) injection of fast particles, (2) plasma injection, and (3) turbulent heating experiments. Each present experiment is briefly discussed. NSA

**N69-38595#** Oak Ridge National Lab., Tenn.
**DOSE RATES IN A SLAB PHANTOM FROM MONOENERGETIC GAMMA RAYS**
H. C. Claiborne and D. K. Trubey 28 Apr. 1969 27 p refs Sponsored in part by DASA
(ORNL-TM-2574) Avail: CFSTI

Gamma-ray flux-to-dose conversion factors obtained with a philosophy consistent with that used for neutron conversion factors have not been available for use in design work. To eliminate this inconsistency and develop more realistic $\gamma$-ray conversion factors, $\gamma$-ray dose rate distributions were determined in a slab phantom of a standard man composition. Calculations were made with the discrete ordinates code ANISN with some checks by the Monte Carlo code OGRE. Based on these results, a recommended curve to convert $\gamma$-ray flux to maximum dose rate delivered to a body was prepared for design use. It was also recommended that a new unit, the maximum exposure dose (MED) be used in shield design work to express the product of the flux, dose-rate conversion factor, and quality factor for both $\gamma$-rays and neutrons.
Author (NSA)

**N69-38596#** National Lead Co. of Ohio, Cincinnati. Feed Materials Production Center.
**NATIONAL LEAD CO. OF OHIO Summary Technical Report for the Period 1 Jan. - 31 Mar. 1969**
R. Burgett, ed. May 1969 23 p refs
(Contract AT(30-1)-1156)
(NLCO-1040) Avail: CFSTI

Ingots with small, medium, and large equiaxed grain structures and with small, medium, and large dendritic grain structures were rolled to 1-1/2-inch diameter rods. Uranium rods rolled from ingots with either small or large equiaxed grain structures had shallower defects than rods rolled from ingots with dendritic grain structures. No effect of ingot grain size on rod defect depth was detected. Tests were made to evaluate the effect of variations in environmental relative humidity on the quantometric determination of 22 impurities in $U_3O_8$. Varying the relative humidity from 46% to 37% caused variations in analytical results ranging from negligible to more than 100%. Uranium-base alloys containing small quantities of Fe, Si, and Al were analyzed for $^{235}U$ with a mass spectrometer. The alloying additives were found to have a negligible effect on isotopic results.
Author (NSA)

# 25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

**N69-37218#** Technische Hochschule, Munchen (West Germany). Elektrophysikalisches Inst.
**TRANSPORT PROPERTIES IN HIGH POWER ARCS Interim Scientific Report, 1 Feb. 1967 - 31 Dec. 1968**
Heinz Maecker Feb. 1969 47 p refs
(Contract F61052-67-C-0081)
(AD-689277; ARL-69-0031) Avail: CFSTI CSCL 20/9

Improved measurements of the E(I)-characteristics for H2 and N2 as well as of the radial temperature distributions up to 26,000K for N2 are accomplished. Together with the already measured temperature distributions in H2 a set of experimental results suitable for the determination of material functions is available now. For H2 a computer program is developed to evaluate the electrical conductivity G(T), the heat flux potential S(T) and the thermal conductivity K(T) by an iteration method. The final results for these material functions up to 26,000K are given. In the case of N2 the energy transport by radiation which is partially reabsorbed within the arc, becomes dominant above 10,000K. Therefore, special methods are applied to determine G(T), K(T) and u(I,T), the differences between emitted and absorbed radiative power per unit volume, up to 26,000K. For Ar computations are made starting from theoretical values of the material functions G(T), K(T) and the coefficients of emission and absorption to determine the radiative behaviour of an Argon arc at 1 atm pressure with a channel diameter of 5mm up to 16,000K. The influence of different assumptions in the theory of emission and the absorption of radiation within the arc are discussed.
Author (TAB)

**N69-37243#** Yale Univ., New Haven, Conn. Dept. of Physics.
**YALE UNIVERSITY Final Report, 18 Feb. 1964 - 30 Jun. 1969**
Henry Margenau Jun. 1969 14 p refs
(Contract Nonr-609(51))
(AD-689381) Avail: CFSTI CSCL 20/9

The document lists reports published under the contract, and includes a paper titled Line Broadening: Statistical and Impact Approximations.
TAB

**N69-37287#** Naval Ordnance Lab., White Oak, Md.
**ON THE INFLUENCE OF AN EXTERNAL MAGNETIC FIELD ON AN MHD MODEL OF A NUCLEAR EXPLOSION**
N. C. Jen and M. Lutzky 7 Feb. 1969 27 p refs
(AD-689110; NOLTR-68-206) Avail: CFSTI CSCL 18/3

A 2-D, Lagrangian, artificial-viscosity type computer code is used to calculate the effect of an initially constant magnetic field on an MHD model of a nuclear explosion. In this model, both the fireball and surrounding medium are fluids with infinite electrical conductivity. It is found that a sufficiently strong magnetic field will elongate the fireball in the direction of the field and increase the shock speed perpendicular to the field. The methods can be extended to treat more realistic cases, such as fluids of finite conductivity and plasmas.
Author (TAB)

**N69-37313#** Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
**SOME STUDIES OF THE KINETIC STATE OF AN EXCITED GAS OR PLASMA INTERACTING WITH RADIATION**
Sotiris P. Kout Soyennis and Krishnamurty Karamcheti Mar. 1969 180 p refs Revised
(Contract Nonr-225(61))
(AD-689230; SNDAAR-327) Avail: CFSTI CSCL 20/9

Some basic experimental and theoretical studies relating to the general problems of determining the kinetic state of a gas are described. Specifically, the studies are concerned with deducing the kinetic state from experimentally observed profiles (shapes) and total intensities of spectral lines of a gas. For the experimental studies, a d.c. excited monatomic gas column consisting of Ne20 or Ne22 or a mixture of another inert gas (mainly He4 is employed). The variations with pressure, discharge current, and discharge wall temperature of the absorption profile parameters such as the maximum absorption coefficient, the shift, the width, and the line shape of the profile, are presented. To account for the observed results, line shape theories were developed. The important excitation and de-excitation processes, as well as the effects of some plasma properties, such as the electron number density and electron temperature of the population processes, were assessed. Difficulties of applying such theories to small diameter and low pressure discharges are discussed. Finally, kinetic equations describing the kinetic state of an excited monatomic gas interacting with radiation are developed, taking into account collisional and radiative processes.
TAB

N69-37326# Bundesministerium fuer Wissenschaftliche Forschung, Bad Godesberg (West Germany).
**SYMPOSIUM ON ONE-PARTICLE DISTRIBUTION FUNCTIONS IN PLASMAS**
M. Fischer, ed. and K. Wiesemann, ed. Jan. 1969 331 p refs Symp. Held in Marburg, West Germany, 25–28 Aug. 1968 (BMwF-FB-K-69-03) Avail: AEC Depository Libraries

Experimental agreement with theory is considered in terms of probe measurements, kinetic models, and plasma wave propagation. For individual titles, see N69-37327 through N69-37348.

N69-37327# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Avionics Lab.
**CRITICAL SURVEY OF THE METHODS FOR FINDING THE ENERGY SPECTRA OF THE CARRIERS IN PLASMAS BY MEANS OF PROBES**
G. Medicus *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 15 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

According to basic probe theory, simple relations exist between the derivatives of the electron (e-) current to the probe in the erepulsion range and the energy spectrum of the plasma electrons. In the experiment these relations are marred more or less severely by a host of secondary effects. Most of these secondary effects (such as plasma noise, inhomogeneity and anisotropy of the plasma, collisions, etc.) cause "rounding of the knee" of the probe curve and corresponding rounding in the derivatives. The following secondary effects are discussed qualitatively: (1) the finite amplitude of the modulation signal in second derivative machines, (2) perturbation of the plasma by the probe (especially shifts of plasma potential during the probe cycle), (3) plasma oscillations and noise, (4) inhomogeneity of the work function of the probe, (5) inhomogeneity and/or anisotropy of the plasma, (6) collisions, and (7) surface effects. Author (NSA)

N69-37328# Paris Univ., Orsay (France). Laboratoire de Physiques des Plasmas.
**ELECTRON VELOCITY DISTRIBUTION FUNCTION IN IONIZED GASES: A SURVEY OF THEORETICAL METHODS AND POSSIBLE COMPARISON WITH EXPERIENCE**
J. L. Delcroix and N. Peyraud *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 25 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

Theoretical methods of computing the one-particle distribution functions and some macroscopic quantities are given for the three classes of plasmas: weakly, moderately, and strongly ionized. In the first class, electron–neutral elastic collisions only are considered, after which the theory is completed for optically thin plasmas by including inelastic collisions associated with excitation and de-excitation of molecule rotations and vibrations. In moderately ionized plasmas, electron–electron and electron–neutral elastic collisions only are first discussed; then it is shown how inelastic and superelastic collisions change the tail of electronic distribution, the population of the first level and the law of ionization in a plasma optically thick for the first transition (resonance radiation). In strongly ionized plasmas, the run-away electron problem is studied. Author (NSA)

N69-37329# Stanford Univ., Calif. Inst. for Plasma Research.
**EXPERIMENTAL VERIFICATIONS OF MICROSCOPIC PLASMA THEORY**
F. W. Crawford *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 38 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

One of the ways in which the detailed shape of the charged particle velocity distribution function in a plasma may manifest itself is in the dispersion characteristics of plasma wave propagation. Indeed, several phenomena, e.g. Landau damping, cyclotron damping, and cyclotron harmonic waves, can only be predicted from a microscopic theory of the propagation. In recent years, experimental agreement with theory based on the Vlasov equation has been demonstrated for such phenomena with a high degree of accuracy for Maxwellian plasmas, in the small-signal propagation limit. Some of the work already carried out is reviewed, and likely future developments in the comparison of theory and experiment for situations where the small-signal approximation breaks down are discussed. Some relevant results on wave/wave interaction are described. Author

N69-37331# Philipps-Universitat, Marburg (West Germany).
**THE ELECTRON ENERGY DISTRIBUTION FUNCTION IN A HIGH-FREQUENCY DISCHARGE**
K. Eidmann *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 8 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

Measurements of the electron distribution function are made in an argon ring discharge by using the Druyvesteyn method. The results indicate Maxwellian energy distributions with slight deviations at energies greater than about the excitation energy. The measurements are compared with calculations of distribution functions by Rother and Wojaczek. Finally measured values of the mean electron energy are presented over a wider range of parameters of the discharge and discussed. Author (NSA)

N69-37332# York Univ. (England). Dept. of Physics.
**MONTE-CARLO MODEL OF A HYDROGEN DISCHARGE**
J. Aiken *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 10 p (See N69-37326 22-25)
Avail: AEC Depository Libraries

A Monte Carlo technique was used to study the important processes occurring in a hot-cathode low voltage arc in hydrogen. The electron energy distribution at a fixed point in a plane diode discharge was used as a direct test of the accuracy of each model. NSA

N69-37333# York Univ. (England). Dept. of Physics.
**ELECTRON ENERGY DISTRIBUTION FUNCTIONS IN THE GRID REGION OF A THREE-ELECTRODE HYDROGEN ARC**
J. M. Trewsdale *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 9 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

Plasma regions close to a single-aperture grid in a low voltage hydrogen arc were studied using a fast-recording Langmuir-probe technique. Measurements of both the normal characteristic and its second derivative were made, allowing computation of both the electron density and energy distribution function. The effects occurring at a single grid aperture in hydrogen were examined in an effort to determine the influence of this region on the behavior of devices of the thyratron type. NSA

N69-37334# Philipps-Universitat, Marburg (West Germany).
**THE INFLUENCE OF A DIAPHRAGM ON THE ELECTRON DISTRIBUTION FUNCTION IN A GAS-DISCHARGE PLASMA**
K. Wiesemann *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 11 p ref (See N69-37326 22-25)
Avail: AEC Depository Libraries

The electron distribution function is measured in a gas discharge constricted by a diaphragm. In the cathode side of the diaphragm a sheath is formed which accelerates the electrons toward the aperture. On the anode side of the diaphragm a beam of fast electrons is found. Comparison of the density of the fast electrons upon the distance from the diaphragm measured in

discharges in helium and xenon with calculations based on a simple model for the accelerated electrons shows the influence of the radial electric field and of the collisions between the electrons and the gas atoms. Author (NSA)

**N69-37336#** Technische Hochschule Stuttgart (West Germany). Institut fuer Gasentladungstechnik und Photoelektronik.
**ELECTRON ENERGY DISTRIBUTIONS IN A NEON DIFFUSION COLUMN WITH STATIONARY STRIATIONS**
B. Saggau and R. Eberle *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 12 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

In a low-current diffusion column, defined by the fact that the mean free path of the electrons is considerably smaller than the tube radius, stationary striations appear at the cathode side of the positive column. Calculations, made under the assumption of Maxwellian energy distribution of the electrons, deliver results that are not in good agreement with experimental values. In particular, the calculations do not agree with measurements of Penning (1928), who found that the potential over one stria is approximately equal to an excitation potential of the gas used, and is not a continuous function of pressure and discharge current, for instance. Because in such plasmas the relaxation length of the electrons is generally much greater than the striation wave length, it is possible that in this case the electron energy distributions are not Maxwellian. The mean electron energy describes approximately a sawtooth function over one stria having a maximum energy equal to the effective excitation energy of the gas. In a neon diffusion column, measurements of the electron energy distribution are made in the region of stationary striations. They verify the theoretical conceptions. Author (NSA)

**N69-37338#** Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
**ON THE VELOCITY DISTRIBUTION OF PARTICLES IN CONTACT IONIZATION PLASMAS**
M. Hashmi, A. J. van der Houven van Oordt, and J. G. Wegrowe *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 12 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

The discrepancy between equilibrium theory and experiments in the low-density range of a contact-ionization plasma can be explained by an enhanced recombination at the hot end plates: thermal equilibrium between plasma particles and hot end plates is assumed. Calculations on the basis of an axial particle velocity exceeding the thermal velocity due to sheath effects are presented and compared with experiments. Author (NSA)

**N69-37339#** FOM-Instituut Voor Plasmafysica, Jutphaas (Netherlands).
**CALCULATED ELECTRON ENERGY DISTRIBUTION FUNCTIONS IN CESIUM AND HELIUM DISCHARGES**
A. J. Postma *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 14 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

The electron energy distribution functions were calculated for discharges in cesium, helium, and helium–argon mixtures. Processes taken into account were elastic and inelastic electron–atom collisions, electron–ion collisions, and mutual electron collisions. From the energy distribution functions the electron drift velocities and the excitation rates were calculated. For a discharge in cesium vapor the calculated drift velocities are compared with measurements. Author (NSA)

**N69-37341#** Yale Univ., New Haven, Conn.
**LOCALLY MAXWELLIAN DISTRIBUTIONS IN A RELATIVISTIC GAS**
Don Kelly and Henry Margenau *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 30 p refs (See N69-37326 22-25)
(Contract Nonr-609-51)
Avail: AEC Depository Libraries

The possible types of locally Maxwellian distributions are determined for a relativistic gas. In the absence of external forces the number of free parameters is eleven, a reduction by two from the number obtained for the nonrelativistic case. The close correspondence of the relativistic and nonrelativistic solutions reveals which two parameters must be zero. Severe restrictions also are placed on the possible types of forces consistent with local equilibrium and the requirements of special relativity. Special attention is directed to the local equilibria open to a gas of charged particles subject to an electromagnetic field. An explicit solution is obtained for the distribution function of such a gas when the fields are constant. Author (NSA)

**N69-37343#** City Coll. of the City of New York.
**COEFFICIENTS OF DYNAMICAL FRICTION AND DIFFUSION IN THE FOKKER–PLANCK EQUATION FOR A TURBULENT PLASMA**
C. M. Tchen *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 16 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

A kinetic equation for a turbulent plasma in a magnetic field is derived in the form of the Fokker–Planck equation. Two methods are used: a mixing-length method and a statistical method based on the Liouville equation. It is shown that the coefficients of dynamic friction and diffusion depend on the spectral functions of turbulent kinetic energy and potential energy. The spectra are analyzed by means of a fluid theory of turbulence, based on the Riemann system for a compressible ion plasma. The spectra and the diffusion are derived for the cases of collision-dominant and collisionless plasmas. The results of diffusion in the velocity space are compared with those of diffusion in the position space. Author (NSA)

**N69-37344#** City Coll. of the City of New York.
**TRANSPORT COEFFICIENTS IN A PLASMA WITH COLLISIONS BY QUASILINEAR APPROXIMATION**
Kwok-Leung Li and Norman C. Jen *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 15 p refs (See N69-37326 22-25)
(Grant AF-AFOSR-1093-68)
Avail: AEC Depository Libraries

The collective behavior of a fully ionized plasma is described by the Boltzmann's equation with Krook's collision term. A small perturbation on the time-independent background distribution function of an infinite homogeneous plasma gives rise to longitudinal plasma oscillations. Consequently, the plasma diffuses in the velocity space. The approach employed is the quasi-linear theory introduced by Drummond, Pines, Vedenov, Velikhov and Sagdeev, who applied it to collisionless plasma. As the fundamental result, this theory leads to a set of two equations, the decay equation describing the Landau damping, and the diffusion equation describing the diffusion of the plasma in velocity space. Author (NSA)

**N69-37345#** FOM-Instituut voor Atoom- en Molecuulfysica, Amsterdam (Netherlands).
**ION-BEAM INTERACTION WITH A BOUNDED ELECTRON PLASMA**
G. J. Brakenhoff, A. Baan, and J. Kistemaker *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 8 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

The applicability of cold-beam plasma theory to the ion beam-plasma interaction is tested. It is found that, when effects of finite dimensions of beam and plasma are taken into account,

a good agreement with experiment in predicted growth rate and interaction frequency is reached. The experiment is carried out in a plasma ($n_e = 1 \times 10^7$ cm$^{-3}$) produced by a slowly diverging 20-keV $H^+_e$ ion beam ($n_{pb} = 2.5 \times 10^6$ cm$^{-3}$). Rf signal growth along the beam is observed. Electron density is measured from the dispersion of propagated waves. Author (NSA)

**N69-37348#** Commissariat a l'Energie Atomique, Saclay (France).
**MEASUREMENT OF THE DISTRIBUTION FUNCTION AND PLASMA WAVE PARTICLE INTERACTION**
R. Frank *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 2 p (See N69-37326 22-25)
Avail: AEC Depository Libraries

Results are mentioned for work on an electron velocity distribution function measurement method and for investigations of interactions between plasma waves and particles using this method. E.C.

**N69-37347#** Philipps-Universitat, Marburg (West Germany).
**KINETIC THEORY OF THE ENERGY SPREAD IN ELECTRON BEAMS**
M. Fischer *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 13 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

The Vlasov equation for the electrons is used to show that the anomalous energy spread in electron beams is due to thermal noise. The kinetic equation is solved to second order in a parameter which is equal to the quotient of thermal velocity over drift velocity. In this way the nonlinearity of the kinetic equation can be retained, giving better values for the correlation functions than those obtainable from a linearized theory. Author (NSA)

**N69-37348#** Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Gas Ionizzati.
**THE ION DISTRIBUTION FUNCTION IN A SIMULATED EXPERIMENT ON THE FORMATION OF A SHOCK WAVE**
G. B. Righetti, L. Enriques, and R. Sciarra *In* Bundesministerium fuer Wiss. Forsch. Symp. on One-Particle Distribution Functions in Plasmas Jan. 1969 17 p refs (See N69-37326 22-25)
Avail: AEC Depository Libraries

A computer-simulated experiment is reported concerning formation and propagation of shock waves in a plasma. The experimental conditions are similar to an earlier-reported experiment on large-amplitude ion waves propagating along the plasma column of a Q machine at different ratios of particle temperatures. The one-dimensional case is studied; electrons are assumed to be governed by the Boltzmann law, and ion sheets are displaced in the self-consistent electric field. As an initial condition, one assumes that there are two regions with uniform but different densities, joined by a region with a linear profile. The propagation of the resulting compression wave is studied at various initial ion temperature and different density ratios. Results indicate that if the ion temperature in the unperturbed plasma is less than the electron temperature, the compression wave propagates with a more-or-less constant slope. Author (NSA)

**N69-37534#** ARO, Inc., Arnold Air Force Station, Tenn.
**A METHOD FOR DETERMINING THE BULK PROPERTIES OF ARC-HEATED ARGON Final Report, Jul. 1967 - Sep. 1968**
R. J. Bryson Arnold AF Station, Tenn. AEDC Jun. 1969 38 p refs
(Contract F40600-69-C-0001)
(AD-689178; AEDC-TR-69-125) Avail: CFSTI CSCL 20/9

The total temperature and total pressure of argon gas at the exit of a direct-current arc jet are determined by using a corrected version of the one-dimensional, constant-area, heat-addition analysis. The corrections are formulated in terms of the thrust produced by the arc jet and are determined by measuring the actual thrust. To assess the validity of properties determined in this manner, a method of characteristics solution of the general potential flow equations was obtained for the flow field resulting from a free expansion of the gas from these properties into a low pressure. Mach numbers given by this solution were then compared with those derived from measured pitot pressures in the expanded stream. The agreement between the predicted and the average measured values of Mach number is within about 4 percent. This would allow the average static temperature to be predicted within about 8 percent and the average static pressure to be predicted within about 18 percent. This indicates that the method of predicting the gas properties at the exit of the arc jet can be used as a first approximation. Author (TAB)

**N69-37583#** Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Gas Ionizzati.
**COLLISIONLESS DRIFT INSTABILITIES IN A BOUNDED PLASMA**
B. Bertotti and A. Nocentini (Trieste Univ.) Dec. 1968 30 p refs
(LGI-68/32) Avail: CFSTI

The effects of emitting plates orthogonal to the magnetic field on the drift modes in the collisionless regime are discussed. The relationship between the current and the electric field is a non-local one in this case, so producing a situation that is much more complicated than in the collisional problem. The local dispersion relation is evaluated with an expansion in Fourier series along the magnetic field; the contribution from the trapped particles is identical to the infinite case, but the free particles provide a coupling between the different modes. In the case of a longitudinal phase velocity lying between the electron and the ion thermal velocities, the drift modes are substantially changed in only two cases. If the transit time of the fastest trapped particles is a multiple of half the period, resonant oscillations of the two sheaths facing the electrodes occur and a new of half the period, resonant oscillations of the two sheaths facing the electrodes occur and a new dispersion relation for modes with a longitudinal wavelength $\lambda$ much larger than the length L of the machine is deduced. For the other modes it is shown that if the instability condition of the infinite case is satisfied for 2L, it is also satisfied for the bounded problem. Author (ESRO)

**N69-37590#** Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Gas Ionizzati.
**EMISSION FROM WAVE-WAVE INTERACTIONS**
J. L. Hirshfield Nov. 1968 27 p refs
(LGI-68/33) Avail: CFSTI

During recent years much research has been carried out on the influence of collective plasma interactions upon the high-frequency conductivity, upon emission, and upon absorption. These notions have been applied in attempts to explain features of type 2 solar radio bursts in the neighborhood of the electron plasma frequency and its first harmonic. In the present report the basic aspects of this question are re-examined insofar as thermal equilibrium wave-wave interactions can contribute to the results. Situations where two thermal-level longitudinal-wave fluctuations combine non-linearly so as to produce a transverse wave which (depending upon plasma optical depth) might radiate out of the plasma are considered. When both of the longitudinal fluctuations are electron waves with $\omega_{pe}$ the quadrupole contribution from electron-electron bremsstrahlung at $\omega \simeq 2\omega_{pe}$ is obtained. When one of the longitudinal fluctuations is an electron wave and the other an ion wave, so that the collective feature emerges near $\omega_{pe}$, the results are in agreement with those for the dipole component of the electron-ion bremsstrahlung. The calculations yield known results by a simpler method than has been previously employed. Although the emphasis is on thermal equilibrium situations (or two-temperature equilibria) the method will be seen to apply equally

to any steady-state where the autocorrelation of electric field fluctuations is known. Author (ESRO)

N69-37679*# Stanford Univ., Calif. Inst. for Plasma Research.
**CYCLOTRONIC HARMONIC WAVE PROPAGATION AND INSTABILITIES. PART 2: OBLIQUE PROPAGATION**
J. A. Tataronis and F. W. Crawford Jun. 1969 32 p refs
(Grant NGR-05-020-077; Contract AT(04-3)326)
(NASA-CR-105928; SU-IPR-326) Avail: CFSTI CSCL 20I

The ring and Maxwellian transverse velocity distribution, which are absolutely unstable and stable, respectively, for perpendicular propagation, are shown here to be both absolutely unstable for oblique propagation. Their instabilities are radically affected by the introduction of axial velocity spread. A detailed study is made for the cases of a Maxwellian transverse distribution with resonance and resonance-squared axial velocity distributions. It is shown that absolute instabilities occur at high energy anisotropies. These become convectively unstable as the anisotropy is reduced, and are quenched as isotropy is approached. The isotropic Maxwellian is treated in detail, and shows both cyclotron and Landau collisionless damping. Author

N69-37680*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**STATIONARY WAVES PRODUCED BY THE EARTH'S BOW SHOCK**
J. K. Perez and T. G. Northrop Aug. 1969 36 p refs
(NASA-TM-X-63670; X-640-69-356) Avail: CFSTI CSCL 20I

Stationary cyclotron waves attached to the bow shock are produced by the current in the shock. Waves upstream from the shock are circularly polarized electron waves, the polarization being in the sense of a right-hand screw when the interplanetary field is directed toward the shock, and left-hand when directed away. The downstream wave field has two components, one from the electron cyclotron branch and one from the ion cyclotron branch of the dispersion relation. The latter has a longer wavelength and a larger amplitude than the electron wave. It is elliptically polarized rather than circularly, and always in the opposite sense to the upstream electron wave. When the ambient magnetic field is not perpendicular to the shock, there also exists a stationary electrostatic wave with its electric field normal to the shock. Both up and downstream the ratio of the electrostatic wave to the magnetic wave amplitudes is of the order $u/c \tan \theta$, where $\theta$ is the angle between the normal to the shock and the magnetic field, and u is the plasma flow velocity. Author

N69-37700*# Stanford Univ., Calif. Inst. for Plasma Research.
**CYCLOTRON HARMONIC WAVE PROPAGATION AND INSTABILITIES. PART 1: PERPENDICULAR PROPAGATION**
J. A. Tataronis and F. W. Crawford Jun. 1969 34 p refs
(Grant NGR 05-020-077; Contract AT(04-3)326)
(NASA-CR-105927; SU-IPR-325) Avail: CFSTI CSCL 20I

Parts I and II of this paper present a comprehensive picture of longitudinal wave propagation in a warm homogeneous magnetoplasma. Part I discusses computed dispersion characteristics for propagation perpendicular to the static magnetic field. For a ring electron velocity distribution it is found that mode coupling and absolute instability can occur. Similar effects are predicted for a spherical shell distribution. The Maxwellian distribution gives rise to stable propagation of undamped waves, and attenuating standing waves. A mixture of ring and Maxwellian distributions can give absolute instability with stronger growth and lower instability thresholds than for the ring distribution alone. Propagation oblique to the static magnetic field will be dealt with in Part II. Author

N69-37708*# Martin Co., Orlando, Fla.
**FLUIDIC PLASMA DISPLAY STUDY, PHASE 2. Final Report, 10 May 1968 - 21 Mar. 1969**
Jaco Van Der Heyden Jun. 1969 55 p refs
(Contract NAS12-532)
(NASA-CR-86237; OR-9930) Avail: CFSTI CSCL 20I

The object of the study was to determine the feasibility of using fluidic systems to control matrix type plasma displays. Utilization of fluidic technique to control these computer readout display systems was found to have distinct advantages over previously developed electronic methods of control. Switching circuits do not have to transfer high voltage control signals, and erroneous display signals caused by impedance changes in the display matrix can be avoided with fluidic control techniques. Author

N69-37768# European Space Research Inst., Frascati (Italy).
**THE HYDROMAGNETIC KELVIN-HELMHOLTZ PROBLEM IN A HALL PLASMA**
J. F. McKenzie [1969] 22 p refs Submitted for publication
Avail: CFSTI

The hydromagnetic analogue of the Kelvin-Helmholtz problem is extended to include the effects of the Hall term. In contrast to other results in the literature it is shown that, in the case of incompressible fluids, the stability of a shear plane is unaffected by the introduction of the Hall term. The special case of a hot, unmagnetized fluid on the other is studied in some detail. In this case it is shown that the presence of the Hall term can have either a stabilizing or a destabilizing effect depending upon whether the sound speed in the hot fluid is very much greater than the Alfvén speed in the cold fluid or vice versa. Author (ESRO)

N69-37774# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
**STUDY OF THE SYNTHESIZED PLASMA RESULTING FROM NEUTRALIZATION OF A MERCURY ION BEAM [ETUDE DU PLASMA DE SYNTHESE RESULTANT DE LA NEUTRALISATION FORCEE D'UN FAISCEAU D'IONS DE MERCURE]**
Gérard Spiess (Ph.D. Thesis--Paris Univ., 25 Nov. 1968) Jun. 1969 205 p refs In FRENCH; ENGLISH summary
(CEA-R-3724) Avail: CFSTI

When an ionic beam is used for space simulation etc. it needs a forced space-charge neutralization by means of electron injection unless the perturbations resulting from the ionic space-charge are eliminated by the self-neutralization of the beam due to the residual gas of the tank. It is shown that it is possible to obtain the forced neutralization of a low energy (a few keV) $Hg^+$ ion beam, 10 cm in diameter, using a neutralizer consisting of a hot emissive filament located within the beam close to the ion source. The computed solution of the plane wave dispersion equation shows that the synthesized plasma resulting from the neutralized beam damps fluctuations of all wavelengths when the average ion velocity is less than the thermal velocity of the neutralizing electrons, assuming that no external electromagnetic field is applied. When a longitudinal electric field is applied by means of a polarized grid in the beam the plasma stability conditions are changed. Author (ESRO)

N69-37854*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
**MICROWAVE INVESTIGATION OF RELAXATION PHENOMENA IN IMPACT HEATED ARGON PLASMA [K VOPROSU O MIKROVOLNOVOM ISSLEDOVANII RELAKSATSIONNYKH YAVLENIY V UDARNONAGRETOY ARGONOVOY PLAZME]**
Yu. S. Lobastov et al Washington NASA Sep. 1969 3 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur (Moscow), v. 7, no. 2, 1969 358-359
(Contract NASw-1692)
(NASA-TT-F-12403) Avail: CFSTI CSCL 20I

The author proposes and demonstrates the validity of investigating relaxation phenomena by measuring the intrinsic microwave radiation. Author

N69-37924# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
**EXPERIMENTAL INVESTIGATION OF THE RAYLEIGH-TAYLOR INSTABILITY OF A ROTATING HYDROGEN ARC IN AN AXIAL MAGNETIC FIELD [EXPERIMENTELLE UNTERSUCHUNG DER RAYLEIGH-TAYLOR INSTABILITAET EINES ROTIERENDEN WASSERSTOFF-LICHTBOGENS IM AXIALEN MAGNETFELD]**
H. F. Doebele Jan. 1969 56 p refs In GERMAN; ENGLISH summary
(IPP-3/83) Avail: CFSTI

A hydrogen arc with a hollow anode in an axial magnetic field shows Rayleigh-Taylor instabilities as a result of rotation due to the radial current components at the anode. These instabilities become manifest in periodic fluctuations of the light intensity emitted from the boundary regions of the arc. The modes $m = 4$ to $m = 7$, which occur successively as the magnetic field increases are identified by measuring the signal phases in end-on observation of the arc. The rotational velocity of the arc plasma is determined spectroscopically and comparison is made with the non-dissipative MHD theory, which yields growth rates $\sim \sqrt{m-1}$. The deviations from this theory that were observed in this experiment can be ascribed to dissipative effects. A model calculation allowing for electrical conductivity, thermal conductivity, and viscosity shows in qualitative agreement with the experiment that with increasing magnetic field the highest growth rate passes successively to the next higher mode.
Author (ESRO)

N69-37955# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
**MEASUREMENT OF THOMSON AND RAYLEIGH SCATTERING IN A PREIONIZATION Z-PINCH [MESSUNG VON THOMSON- UND RAYLEIGHSTREUUNG AN EINEM VORIONISIERUNGS- Z-PINCH]**
H. Röhr Feb. 1969 19 p refs In GERMAN; ENGLISH summary
(IPP-1/95) Avail: CFSTI

A 90° scattering experiment with a pre-ionization Z-pinch is described, including conventional measurements of electron temperature and density (Thomson scattering). Rayleigh scattering from excited hydrogen atoms was observed during very early phases of the discharge. This observation is rendered possible because the Rayleigh scattering cross-section of hydrogen atoms in the second and third quantum states is very large owing to the small difference in the energy of the $H\alpha$ (6563 Å line and the light of a ruby laser (6943 Å). Spectral resolution of this part of the scattered light gives a minimum value for the ion temperature.
Author (ESRO)

N69-37970*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
**AN EXPERIMENTAL INVESTIGATION OF THE COEFFICIENTS OF ELECTRIC CONDUCTIVITY AND THERMAL CONDUCTIVITY OF PLASMA IN AIR [EKSPERIMENTALNOYE ISSLEDOVANIYE KOEFFITSIYENTOV ELEKTROPROVODNOSTI I TEPLOPROVODNOSTI PLAZMY NOZDUKHA]**
E. I. Asinovskiy et al Washington NASA Aug. 1969 10 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur (Moscow), no. 2, April/May 1969 p 217–222
(Contract NASw-1982)
(NASA-TT-F-12416) Avail: CFSTI CSCL 20I

Equipment was built to represent a constant current arc stabilized by a wall in air under atmospheric pressure. Data were obtained on the coefficient of electrical conductivity in the temperature interval 700° to 11,000°K and the coefficient of thermal conductivity in the temperature interval 6,000° to 14,000°K.
Author

N69-37994# Uppsala Univ. (Sweden). Inst. of Physics.
**PLASMA EFFECTS FOR Λ PARTICLES AND $O^{16}$ IONS IN SILICON DETECTORS**
P. A. Tove, W. Seibt, and K. E. Sundström May 1969 19 p refs
(UUIP-649) Avail: CFSTI

Injection of strongly ionizing particles such as α-particles and oxygen ions into semiconductor detectors give rise to plasma effects which change the simple picture of charge collection valid for lightly ionizing particles, e.g. protons. The observable current pulse in the detector therefore becomes different in the mentioned three cases. Measurement results are compared with a previously designed theoretical model which assumes that erosion of the created plasma is caused by transient space charge limited currents from the plasma edge.
Author (ESRO)

N69-38010*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
**SUMMARY OF XB-70 AIRPLANE COCKPIT ENVIRONMENTAL DATA**
Kirk S. Irwin and William H. Andrews Washington Oct. 1969 24 p refs
(NASA-TN-D-5449) Avail: CFSTI

Thermal, acoustical, and acceleration environmental data were obtained for the crew compartment of the XB-70 airplane during the 186-flight-hour airworthiness test program. Temperature levels, gradients, and time histories are presented for the cockpit walls, floor, and windshields. Heat transfer through the walls and along the floor produced no crew discomfort. Thermal radiation from the hot inner windshield would have been objectionable to the crew if they had not been protected by insulated flight suits and helmets with faceplates. The acoustical environment of the crew compartment was similar to that of other military turbojet bomber aircraft. At Mach 3 the sound-pressure level in the XB-70 cockpit, primarily generated by onboard electrical and environmental equipment, was 96 decibels, which is about 10 decibels higher than that measured on a present subsonic jet transport. Subsonically, the cockpit noise levels exceeded military specification limits by as much as 10 decibels at frequencies above 400 hertz. At cruise conditions the cockpit noise levels exceeded the supersonic transport internal-noise-level design criteria in the frequency range above 300 hertz. Acceleration data for the XB-70 crew compartment and center of gravity are presented for taxi, takeoff, subsonic buffet, and atmospheric-turbulence conditions.
Author

N69-38076# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
**EXPERIMENTAL AND THEORETICAL INVESTIGATION OF A LOW FREQUENCY INSTABILITY IN A MODIFIED PIG DISCHARGE [EXPERIMENTELLE UND THEORETISCHE UNTERSUCHUNG EINER NIEDERFREQUENTEN INSTABILITAET IN EINER MODIFIZIERTEN PENNING-ENTLADUNG]**
F. Klan Apr. 1969 75 p refs Apr. 1969 75 p refs In GERMAN; ENGLISH summary
(IPP-3/92) Avail: CFSTI

A low frequency instability observed in a modified PIG discharge is shown to be a $m = 1$ distribution of the electron temperature moving approximately with the $E \times B$ drift velocity around the discharge axis. This abnormal temperature distribution is not accompanied by a similar density distribution. To explain the observed instability, a linear perturbation theory is developed based on the electron energy equation including appropriate source terms. From this theory a dispersion relation is obtained, the real part of which gives the phase velocity of the temperature perturbation, whereas the imaginary part may be used to give a stability criterion. It is found that velocity of the perturbation should be nearly equal to the $E \rightarrow \times B \rightarrow$ drift velocity of electron gas, and that the amplitude may grow exponentially in time if the magnetic field is sufficiently high and the neutral gas pressure is low enough. Both of these results are in good quantitative agreement with the experiments.
Author (ESRO)

N69-38099# Illinois Univ., Urbana. Coordinated Science Lab.
**EFFECT OF A BOUNDARY ON THE BEAM PLASMA INSTABILITY**
Kenneth Evans, Jr. and E. Atlee Jackson Jul. 1969 11 p refs
(Contract DAAB07-67-C-0199)
(AD-690128; R-422) Avail: CFSTI CSCL 20/9

In recent years there has been considerable interest in the spatial-temporal growth of instabilities arising when a beam is injected into a plasma. There does not appear, however, to be any theoretical treatment of the modification of the growth of an initial perturbation due to the presence of a spatial boundary. This modification will be illustrated for the case of a monoenergetic electron beam injected into a cold plasma with an infinitely massive ion background. The treatment is based on the linearized hydrodynamic equations and Maxwells equations for the normalized densities, the drift velocities, and the electric field. TAB

N69-38151# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
**EFFECTS OF AZIMUTHAL COMPONENTS OF THE ELECTRIC FIELD IN A Q-DEVICE [DIE ROLLE AZIMUTALER KOMPONENTEN DES ELEKTRISCHEN FELDES IN EINER Q-MASCHINE]**
E. Gudino Mar. 1969 55 p refs In GERMAN; ENGLISH summary
(IPP-2/76) Avail: CFSTI

Azimuthal components of the electric field in Q-machine plasmas occur if the distribution of temperature over the endplate is deviating from rotational symmetry. In this case $E_\theta \times B_z$ drifts give rise to plasma loss rates which are comparable in magnitude to Bohm diffusion. This effect is verified experimentally in a double-ended Q-machine (ALMA III). A new heater system for the end-plates using rotating cathodes yields temperature distributions which are symmetrical to within 0.1%. Under these conditions the loss rate is reduced by a factor 10 - 60 as compared to Q-machines with conventional heater systems. Author (ESRO)

N69-38186*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
**THEORY OF NON-EQUILIBRIUM LOW-TEMPERATURE PLASMA [K TEORII NERAVNOVESNOY NIZKOTEMPERATURNOY PLAZMY]**
L. M. Biberman et al Washington NASA Sep. 1969 50 p refs Transl. into ENGLISH from the book "Magnitogidrodinamicheskiy Metod Polucheniya Elektroenergii" Moscow, Energiya Press, 1968 p 209-263
(Contract NASw-1692)
(NASA-TT-F-12426) Avail: CFSTI CSCL 20I

A theory is proposed which will permit determining the degree of ionization and the distribution of plasma particles based on the states of the discrete and continuous spectra in the absence of equilibrium. The nonequilibrium may be due to relaxation processes, radiation yield, emission of charged particles and non-isothermicity of the plasma components. The theory is based on the successive application of the diffusion approach to the motion of particles in the energy space. Correct allowance for the discreteness of the levels required using the apparatus of finite differences. Analytical expressions were found for the population of the levels, the rate of ionization and the distribution function of the electrons according to velocities. A comparison is made with the results of experimental research. Author

N69-38216# Toulouse Univ. (France). Faculte des Sciences.
**STUDY OF THE VARIATION OF ELECTRON TEMPERATURE AND ELECTRON DENSITY IN A PLASMA UNDER HF ELECTRIC EXCITATION [ETUDE DE LA VARIATION DE TEMPERATURES ELECTRONIQUES ET DES DENSITES ELECTRONIQUES DANS UN PLASMA A EXCITATION ELECTRIQUE DE HAUTE FREQUENCE]**
Christian Saint-Martin (Ph.D. Thesis) 1969 90 p refs In FRENCH; ENGLISH summary
(NP-17903) Avail: CFSTI

Using multiple floating probes, of which the theory has been adapted to the case of high-frequency electrical discharges, the variation of the electron temperature and density was studied. The abnormal evolution of electron density is linked to the existence of two discharge regimes. The dark regime is characterized by a weak density. A higher density corresponds to the bright regime, as well as a stronger luminosity. The passing from one regime to another occurs suddenly, and is accompanied by a change in the evolution of the electron density. A theoretical study carried out, starting from the resonant discharge theory, takes into account this abnormal variation of the electron density at the time of a change in the regime. Author (NSA)

N69-38227*# Lockheed Missiles and Space Co., Palo Alto, Calif.
**RADIANT ENERGY TRANSFER MEASUREMENTS IN AIR**
Allen D. Wood and Kenneth H. Wilson Washington NASA Oct. 1969 99 p refs
(Contract NAS7-579)
(NASA-CR-1390; LMSC-681796) Avail: CFSTI CSCL 20I

Temperatures and total radiant intensities were measured in air plasmas created in the reflected shock region of a 12-inch diameter, arc-driven shock tube. The temperatures were used to explore the difference between the total intensity measurements and theoretical predictions which were evaluated at the gasdynamic property values. The temperature measurements utilized the following spectroscopic techniques: (1) measuring the integrated intensity of certain atomic lines and multiplets; (2) fitting profiles to measured line shapes; and (3) measuring the spectral intensity of the continuum at 4935 Å. Temperatures between 10,750°K and 13,000°K were measured with a typical precision of ± 4%. This precision could not be maintained at higher temperatures. The results indicate that, on the average, the measured temperatures were 4% below the gasdynamic values, which could account for the difference between the total intensity measurements and the predictions in this temperature range. Further, the erratic shot to shot deviations of 0 to 8% between the measured and gasdynamic temperatures suggest that the actual plasma temperatures were not adequately predictable from the incident shock velocity. Author

N69-38259# Academy of Sciences (USSR), Moscow.
**DETECTION AND ANALYSIS OF INDUCED EMISSION IN ARGON PINCH DISCHARGES**
A. N. Vasil'eva, V. B. Zaremba, V. M. Likhachev, M. S. Rabinovich, and V. M. Sutovskii 1968 64 p refs In RUSSIAN
(NP-17892) Avail: AEC Depository Libraries

Pinch discharges are first discussed, considering experimental installations, electrical characteristics of the discharge, optical measurements, and the mechanism of the pinch-discharge development. The induced emission in pinch-discharge plasma is then considered, taking into account generation in Ar + ions of emissions of 4765 and 4880 Å, and the intensity of generation as a function of initial pressure in the discharge chamber, the diameter and rate of current increase, the generation appearance moment, and the duration and time characteristics of the pinch discharge. The generation in $Ar^{2+}$ of emissions of 3511 and 3638 Å, the moment of appearance and the duration of generation, intensity and maximum frequency of induced emission pulses are discussed, as well as preliminary ionization of the gas and the energy of emission. NSA

N69-38260# Stanford Univ., Calif. Inst. for Plasma Research.
**STUDIES OF PLASMA OSCILLATIONS Status Report No. 33, 1 Aug. 1968 - 31 Jan. 1969**
F. W. Crawford Feb. 1969 46 p refs
(Contract AT(04-3)-326)
(SU-IPR-283) Avail: CFSTI

The activities reported include the following topics: (a) Low-frequency ion–acoustic and drift waves on the positive column in a magnetic field. An rf perturbation theory based on a self-consistent solution for the steady-state column has been derived, and is being tested experimentally. (b) Electron cyclotron echoes. The response of a magnetoplasma to short pulses at the cyclotron frequency is being studied. The detailed physical description of the phenomena involved permits the development of techniques for plasma density measurement and determination of collision data. (c) Beam/plasma interaction. The aspect of this phenomenon currently being studied is the effect on the interaction of bounded beam and plasma geometry. (d) Wave/wave interactions. The basic equations of small-signal plasma wave theory may now be considered to have been well verified experimentally, and higher-order approximations can be attempted. Work in this direction concerns the nonlinear coupling of cyclotron harmonic waves, extraordinary modes, and whistlers. Author (NSA)

**N69-38326#** United Kingdom Atomic Energy Authority, Culham (England).
**EXPERIMENTAL RESULTS ON THE SUPPRESSION OF THE FLUTE INSTABILITY BY A FEEDBACK SYSTEM ON PHOENIX 2**
V. Chuyanov Jan. 1969 23 p refs Transl. into ENGLISH from Russian Paper
(NP-tr-1774; CTO-598) Avail: AEC Depository Libraries

The stabilizing system and diagnostic apparatus are described. Loss measurements were made and it was found that certain modes of the instability could be suppressed at these densities. NSA

**N69-38328#** United Kingdom Atomic Energy Authority, Culham (England).
**EXPERIMENTAL INVESTIGATION OF THE EFFICIENCY OF RAPID PLASMA HEATING METHODS**
L. V. Dubovoi and V. P. Fedyakov [1968] 10 p refs Transl. into ENGLISH from Russian Preprint
(NP-tr-1775; CRO-520) Avail: CFSTI

The generation and absorption in a plasma of an ion cyclotron wave in which the peak value of the variable magnetic field components $H_z$ in the region of the exciting circuit varied from 0.05 to 0.6 of the stationary confining field $H_z$ = 2.13 kG were investigated. The time for generating a wave packet was $\sigma t \approx 10^{-6}$ sec and, under the experimental conditions, always satisfied the relation $\sigma t \leq \tau$. NSA

**N69-38341#** Sandia Corp., Albuquerque, N.Mex.
**PLASMA EXPANSION INTO A VACUUM ENVIRONMENT**
D. L. Mangan Apr. 1969 32 p refs Sponsored by AEC
(SC-R-69-1270) Avail: CFSTI

The problem of plasma expansion into a vacuum is studied. The problem is stated as follows: Given a finite point source of plasma determine the number density and the electric field as a function of space and time. Author (NSA)

**N69-38347#** Stanford Univ., Calif. Inst. for Plasma Research.
**LOW FREQUENCY WAVES AND INSTABILITIES ON THE POSITIVE COLUMN IN A MAGNETIC FIELD. PART 3: EXPERIMENTS ON ASYMMETRIC MODES**
A. J. Duncan, J. R. Forrest, F. W. Crawford, and S. A. Self Mar. 1969 30 p refs
(Contract AT(04-3)-326)
(SU-IPR-288-Pt-3) Avail: CFSTI

In Parts I and II of this series, a theory was developed and studied numerically describing low-frequency wave propagation along a weakly ionized positive column in a magnetic field. $B_z$. Part III describes experimental verification of the analysis, based on observation of electron waves propagating along a low-pressure mercury-vapor discharge. For propagation in the direction of the axial electron drift, an azimuthal mode number $m \geq 1$, and rotation in the sense of the electron diamagnetic drift, these helical waves show a transition with increasing $B_z$ from damping to spatial growth. Measurements of the wave-dispersion characteristics as a function of $B_z$ show reasonable agreement with theory for the first two radial modes of m = 1. The behavior of the spectrum of self-excited waves, and the dependence of the steady axial electric field on $B_z$, are interpreted in terms of the linear perturbation theory. Author (NSA)

**N69-38443#** Stanford Univ., Calif. Inst. for Plasma Research.
**INTERACTION OF A CYLINDRICAL BEAM WITH A PLASMA. PART 1: THEORY**
S. A. Self Jan. 1969 55 p refs
(Contract AT(04-3)-326)
(SU-IPR-275) Avail: CFSTI

A linear analysis is given of the interaction of a homogeneous, mogoenergetic cylindrical electron beam, of radius a, with a homogeneous, cold plasma for two cases: (A) the plasma is unbounded, (B) the plasma is bounded by a conductor at radius b (>a). The quasi-static approximation is compared with an exact treatment, and conditions for the validity of the former are stated. A stability analysis according to the method of Derfler and Briggs is carried out in terms of the mapping of $\omega$ into the complex k plane. It is shown that the system is always absolutely unstable and the dependence of the stability analysis on the system parameters is discussed. The absolute instability is, however, always sufficiently weak that in practice the stabilizing effect of collisions is sufficient to quench it, leaving a convective instability. Author (NSA)

**N69-38444#** Stanford Univ., Calif. Inst. for Plasma Research.
**INTERACTION OF A CYLINDRICAL BEAM WITH A PLASMA. PART 2: EXPERIMENT AND COMPARISON WITH THEORY**
S. A. Self Jan. 1969 49 p refs
(Contract AT(04-3)-326)
(SU-IPR-276) Avail: CFSTI

Measurements were made on a beam–plasma system under particularly simple and well-defined conditions. The system could be operated at will in three distinct regimes, namely (1) a quiescent steady-state regime, (2) a linear growth regime, and (3) a nonlinear regime. The characteristics of the steady state are shown to agree with a static theory for a beam-generated plasma. Measurements of spatially growing waves in the linear regime are described and compared with the theory. Reasonable agreement is found when the effects of finite beam radius and collisions are taken into account, but it is indicated that the effect of radial inhomogeneity is also important. Some preliminary measurements on the nonlinear regime are reported and discussed in terms of the available nonlinear and quasi-linear theories. Author (NSA)

**N69-38469#** Sandia Corp., Albuquerque, N.Mex.
**PLASMA EXPANSION INTO A VACUUM ENVIRONMENT**
D. L. Mangan [1968] 18 p refs Presented at Southwest Regional Conf., Albuquerque, N.Mex.
(SC-DC-69-1772; CONF-690408-1) Avail: CFSTI

Preliminary efforts of an investigation of plasma expansion into a vacuum are discussed. The problem is stated as: Given a finite point source of plasma, determine the number density n(r,t) and the electric field E(e,t) as a function of space and time. NSA

**N69-38479#** United Kingdom Atomic Energy Authority, Culham (England).
**DETERMINATION OF THE PARAMETERS OF A PLASMA FORMED BY THE EFFECT OF MICROWAVE POWER IN A MAGNETIC FIELD – PULSED CONDITIONS**
A. I. Anisimov et al [1969] 14 p refs Transl. into ENGLISH from the Russian
(NP-TR-1788; CTO-612) Avail: CFSTI

Microwave power was applied to a steady-state plasma

formed in a magnetic field by the effect of microwave power in the 3-cm-wavelength region in electron cyclotron resonance conditions. The applied microwave pulse was of roughly the same frequency but much larger power. Its length was about 20 μsec, its power about 20 kW. The absorption of the microwave energy and the change in the plasma parameters under its influence were investigated. Author (NSA)

**N69-38498#** Academy of Sciences (USSR), Leningrad. Fiziko-Tekhnicheskii Inst.
**DETERMINATION OF THE TRANSVERSE DIFFUSION COEFFICIENT IN PLASMA WITH HIGH ELECTRON TEMPERATURE IN MAGNETIC FIELD**
V. N. Budnikov 1968 7 p refs In RUSSIAN
(NP-17897) Avail: AEC Depository Libraries

Experiments were conducted concerning the dependence of the minimum pressure for the existence of discharge in a homogeneous magnetic field on the length and diameter of the plasma. Results indicate that the minimum pressure for existence of discharge does not depend on plasma length within the limits of the experiment, i.e., 10 to 70 cm. The cessation of the discharge was not related to the longitudinal drift of the charged particles. An explanation is offered for the fact that the charged-particle losses are related only to transverse drift. The minimum pressure, charged-particle lifetime, and diameter should be related as follows: $p_{min} \sim 1/\tau_{\perp} \sim 1/d^2$. The experimental data, however, contradict this relationship, and attempts are made to explain this. Author (NSA)

**N69-38500#** California Univ., Livermore. Lawrence Radiation Lab.
**WAZER: A ONE-DIMENSIONAL, TWO-TEMPERATURE HYDRODYNAMIC CODE**
Ray E. Kidder and William S. Barnes 31 Jan. 1969 26 p refs Sponsored by AEC
(UCRL-50583) Avail: CFSTI

The physics and mathematics used in the computer code WAZER are described. This code can perform calculations on plasmas which involve thermal diffusion, heat transfer between ion and electron populations, heat loss from the electrons due to radiation, hydrodynamic effects, absorption of laser light, fusion, and loss of energy across the boundaries in the form of either heat or work. The description includes the mathematical formulation of the physical laws involved and the differencing techniques used to solve the partial differential equations of heat transport and hydrodynamic motion. Author (NSA)

**N69-38822#** Los Alamos Scientific Lab., N.Mex.
**STABILIZATION OF A PLASMA BY HIGH FREQUENCY ELECTROMAGNETIC FIELDS**
R. A. Demirkhanov 1969 35 p refs Transl. into ENGLISH from the 2d Intern. Conf. on the Interactions between Oscillating Fields and Plasmas, Saclay, France, v. 3, Jan. 1968 p 809–913
(LA-4056-TR) Avail: CFSTI

A survey is given of studies of the possibility of suppressing hydrodynamic and kinetic instabilities in a magnetized plasma by means of high-frequency electromagnetic fields. Results are given for experiments carried out at the Sukhumi Physico-Technical Institute in which the possibilities of suppressing a flute hydrodynamic instability, and a drift-type microinstability by high-frequency fields were studied. The problems of the interaction of large-amplitude high-frequency fields in the region of the skin layer are discussed. Results of a study of the plasma-column equilibrium in a torus in the presence of helical high-frequency electromagnetic fields of the quadropole type are also given. Author (NSA)

**N69-38840#** Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
**INVESTIGATION OF UNIVERSAL PLASMA INSTABILITIES Annual Progress Report**
H. Lashinsky 1 Jun. 1969 18 p refs
(Contract AT(40-1)-3405)
(TID-25120; APR-4) Avail: CFSTI

A brief review of research during this period is given for the following: (1) wave-instability physics, (2) Q-machine technology, and (3) general experimental methods and technological spinoff possibilities. NSA

**N69-38845#** Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sukhumi (USSR). Fiziko-Tekhnicheskii Institut.
**DEVELOPING HIGH-FREQUENCY FIELDS IN PLASMA INSTALLATIONS**
G. I. Zverev, I. S. Savchenko, V. B. Maiburov, V. L. Lyulev, and M. Sh. Burdiashvili 1969 18 p refs In RUSSIAN
(NP-17893) Avail: AEC Depository Libraries

Systems designed for producing high-frequency magnetic fields of various configurations in the frequency range from 0.1 to 5 mHz are described. The fields are developed by currents in symmetrical eight-bar windings, which together with the connected capacitors, form resonance contours for powerful vacuum-tube oscillators. Data are given on the design and performance of high-frequency generators using pulsed-generator triodes of Soviet construction. NSA

**N69-38851#** Academy of Sciences (USSR), Leningrad.
**RELATION OF COEFFICIENT OF TRANSVERSE DIFFUSION OF CHARGED PARTICLES OF PLASMA IN A MAGNETIC FIELD TO ELECTRON TEMPERATURE**
V. N. Budnikov and V. E. Golant 1968 7 p refs In RUSSIAN
(NP-17896) Avail: AEC Depository Libraries

Steady-state plasma formed under the action of uhf power in the electron cyclotron resonance regime was studied. With microwaves sources in the 3-cm range and magnetic fields up to 3400 Oe, plasma was created in dielectric and metallic cylinders of diameter 2.5 cm and lengths up to 80 cm, on being filled with hydrogen at pressures of $3 \times 10^{-5}$ to $5 \times 10^{-2}$ mm Hg. These experiments showed the accelerated transverse drift of charged particles characterized by times of 2 to 3 orders of magnitude greater than the times of collision transverse diffusion. The transverse diffusion coefficients show little change over wide limits of temperature change (1 to $10^3$ eV). Oscillations were discovered corresponding to the range of drift frequencies, and experimental conditions correspond to theoretical conditions for emergence of drift-type instabilities. Although the anomalous transverse diffusion must be related to instability, its nature can be completely understood only by a more detailed investigation of the spectrum of oscillations. Author (NSA)

# 26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

**N69-37208#** Naval Ordnance Lab., White Oak, Md.
**PHOTOSENSITIVITY IN EPITAXIAL PbS FILMS, VOLUME 2**
H. Raymond Riedl 29 Jan. 1969 22 p refs
(AD-688770; NOLTR-68-24-Vol-2) Avail: CFSTI CSCL 20/12

Single crystal films of lead sulfide have been subjected to heat treatments involving oxygen and sulfur vapor in order to determine the effect of such treatments upon the photosensitivity at room temperature. In no instance was a photoconductive effect observed. The observed photosensitivity was shown to be of a photovoltaic nature. Author (TAB)

**N69-37230#** Idaho Nuclear Corp., Idaho Falls. Nuclear and Chemical Technology Div.
**MATERIALS**
*In its* Nucl. Technol. Branch Dec. 1968 p 141–179 refs (See N69-37226 22-24)
Avail: CFSTI

Crystal lattice structures and dynamics were studied on organic and inorganic compounds as well as on ethylene polymers. Neutron scattering cross sections on polyethylene were obtained. The crystal lattice dynamics of beryllium oxides, diamonds, magnesium stannate, sodium chloride, thallium, and zirconium were observed. Valence force models were formed for diamonds and silicon.
NSA

**N69-37272*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ABSORPTION OF HYDROGEN BY PALLADIUM AND ELECTRICAL RESISTIVITY UP TO HYDROGEN-PALLADIUM ATOM RATIOS OF 0.97**
Dumas A. Otterson and Robert J. Smith Washington Sep. 1969 17 p refs
(NASA-TN-D-5441) Avail: CFSTI CSCL 20L

The electrical resistivity of the palladium-hydrogen system ($PdH_x$) was measured to a H/Pd atom ration x of 0.97 at 4.2° and 273°K. The Bambakidis, Smith, and Otterson model proposed for the palladium-deuterium system ($PdD_x$) is applied to PdH. The model is used to explain the concentration dependence of the peak in resistivity as a function of temperature near 50°K and the concentration dependence in the resistivity scatter due to quench rate observed at 4.2°K. The present results are virtually independent of hydrogen isotope effects. Techniques used to attain values of x up to 0.97 are given. Hydrogen retention by these specimens is discussed.
Author

**N69-37294#** California Inst. of Tech., Pasadena. Dept. of Electrical Engineering.
**CHANNELING IN SEMICONDUCTORS AND ITS APPLICATION TO THE STUDY OF ION IMPLANTATION**
Samuel Thomas Picraux Apr. 1969 123 p refs
(Contract F19628-68-C-0142)
(AD-689187; SR-1; AFCRL-69-0199) Avail: CFSTI CSCL 20/12

The channeling characteristics of protons and helium ions in various diamond-type lattices (diamond, Si, Ge, GaP, GaAs, GaSb) have been studied by means of elastic backscattering in the 0.5 to 2 MeV range. Critical angles and minimum yields have been measured and compared to theory. Channeling and electrical measurements are combined to study ion implanted impurities in silicon. The anneal behavior of Cd and Te implantations (20-50 keV) into Si at substrate temperatures of 23 degrees C and 350 degrees C were investigated.
Author (TAB)

**N69-37298#** Florida Univ., Gainesville. Dept. of Electrical Engineering.
**A CENTER OF COMPETENCE IN SOLID STATE MATERIALS AND DEVICES Interim Report**
Fred A. Lindholm, Arthur J. Brodersen, Eugene R. Chenette, Derek B. Dove, Robert W. Gould et al Apr. 1969 305 p refs
(Contract F19628-68-C-0058, ARPA Order 1060; Proj. Themis)
(AD-688220; THEMIS-UF-SR-3; AFCRL-69-0147) Avail: CFSTI CSCL 20/12

The report describes technical findings in three main areas. The first area concerns semiconductors and semiconductor devices. Noise in integrated operational amplifiers is characterized, with special emphasis given to burst noise. Measurements are made of the photomagnetoelectric and photoconductive effects in n-type silicon at cryogenic temperatures and attendant theory is developed. Another study delineates issues basic to device modeling for the computer-aided analysis and design of integrated circuits. The second main area deals with measurement techniques. Use of the field ion microscope is discussed for the analysis of dislocations and stacking faults in crystals. A new method for studying the structure of thin films during the earliest stages of growth is described; the techniques of electrically recording diffraction patterns are reviewed and applied to characterizing surfaces and surface layers on an atomic scale. The application of quantitative dielectric relaxation receives attention as an analytical tool in the investigation of insulating and semiconducting materials. The third main area concerns insulating and semiconducting glasses. One study describes the effects of neutron bombardment on nucleation and growth processes. Another deals with the information on the nucleation sequence provided by hot-stage transmission microscopy of Lithia-silica glass. A final study reports concerning the effect of environment on the dielectric properties of high alumina substrates.
Author (TAB)

**N69-37379*#** Hiram Coll., Ohio. X-Ray Physics Lab.
**DEFECT PRODUCTION IN SINGLE CRYSTALS RESULTING FROM ION BOMBARDMENT Semiannual Status Report, 1 Jul. 1968 – 30 Jun. 1969**
Lawrence B. Shaffer 29 Aug. 1969 21 p refs
(Grant NGR-36-019-001)
(NASA-CR-105505; SASR-5) Avail: CFSTI CSCL 20B

Damage produced on the surface of metal single crystals during ion bombardment was investigated using ultrahigh vacuum X-ray techniques. Equipment delays are reported for the vacuum system and ion gun which delayed testing, as well as lack of local facilities for the necessary repairs. Only preliminary data are therefore available; these appear to indicate that the expected line broadening on copper and germanium due to ion damage is less than the precision of the measurement and possible unmeasureably small. The future schedule includes damage studies in new copper crystals in renewed attempt to obtain double crystal topographs as a possibly more precise method of determining ion bombardment defects.
A.C.R.

**N69-37630#** International Business Machines Corp., Yorktown Heights, N.Y. Watson Research Center.
**EXPERIMENTAL AND THEORETICAL PHYSICS Final Report, 31 May 1966 – 31 May 1969**
L. Esaki Jun. 1969 10 p refs
(Contract DA-31-124-ARO(D)-478)
(AD-689498; AROD-5840.20-P) Avail: CFSTI CSCL 20/12

A study was proposed to examine the electronic properties of the IV-VI compound semiconductors and the group V semimetals primarily because of the intriguing properties of these materials. Many of these materials have a crystal structure which is a small deviation from simple cubic. They have narrow direct energy gaps, in general high electron and hole mobilities, and high optical and static dielectric constants.
Author (TAB)

**N69-37635#** Arizona State Univ., Tempe. Engineering Research Center.
**A STUDY OF THE METAL-SEMICONDUCTOR (N-TYPE) RECTIFYING CONTACT**
Hugh Allen Lindsey and Thomas A. Demassa May 1969 199 p refs
(Contract F44620-69-C-0025)
(AD-689294; TR-1; AFOSR-69-1224TR) Avail: CFSTI CSCL 20/12

A theoretical study of metal-semiconductor (N-type) rectifying contacts is developed. This study begins by first analyzing previous models for this type of junction. Particular attention is given to the Schottky model and to the approximations it contains. This model is then improved upon by taking into account nonuniform impurity ionization and the free electron concentration in the depletion region. Using this more exact model a theoretical expression for the differential junction capacitance is calculated. The results indicate that the junction capacitance as a function of reverse bias can be

used to accurately predict the doping concentration in the semiconductor material, but does not yield a correct measurement of the equilibrium diffusion potential or barrier height. The current voltage characteristic for this type of contact is also discussed. An expression for the I-V characteristic of this junction is derived based upon a diffusion model. This expression is then improved upon by accounting for tunneling and quantum mechanical reflection of carriers at the junction. Author (TAB)

**N69-37683#** Council for Scientific and Industrial Research, Pretoria (South Africa). Foreign Language Service.
**EFFECT OF LIGHT PULSE ON THE DISLOCATION STRUCTURE OF SODIUM CHLORIDE [VLIIANIE SVETOVYKH IMPULSOV NA DISLOKATSIONNUIU STRUKTURU KHLORISTOGO NATRIA]**
T. M. Averianova et al. 1968 13 p refs Transl. into ENGLISH from Kristallografiia (Moscow), v. 12, no. 6, 1967 p 1022–1029 /ts Ref. 720
Avail: CFSTI

Crystals of NaCl, subjected to the action of a laser pulse of $10^{-3}$ and $10^{-8}$ seconds duration, were studied by the etching method. It was found that a crater formed at the point of focus of the laser beam and was surrounded by an orthogonal network of fissures and slip bands consisting of screw dislocations. When the beam was focused inside the crystal, no crater was formed, and the plastic deformation consisted chiefly of edge dislocations parallel and perpendicular to the beam. Cleavage in the [100] plane revealed fissures and slip bands of various types. High-speed photography revealed that the fracturing induced by focusing the beam inside the crystal increased gradually during the action of the light pulse. Author

**N69-37790#** Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
**X-RAY DIFFRACTION STUDIES OF THERMAL MOTIONS IN CRYSTALS Final Report, 1 Jun. 1958 – 31 May 1966**
R. A. Young Jun. 1969 30 p refs
(Contracts Nonr-991(06); Nonr-991(00))
(AD-689387; GIT-A-389-F) Avail: CFSTI CSCL 20/2

Primarily through abstracts of reports and published papers, this final report recounts project work done from 1958 through 1966 on x-ray studies of thermal motions in crystals. Principal use was made of the temperature dependence of x-ray Bragg-reflection intensities. Precision was emphasized. Both new experimental procedures and new analytical procedures were developed to produce and to exploit the precision inherently available. Instrumental design and use strategy, X-specimen temperature control, understanding and control of the background, and wavelength control received extended attention. Analytic techniques were developed to yield from continuous intensity-vs-temperature data, absolute Debye temperatures and separate measures of Na and Cl (or Ag and Cl) atomic thermal motions in crystals with NaCl structure. The resulting information was surprisingly detailed. For example, comparison with calculations based on the elastic spectrum of Al showed the experimentally observable quantities to be sensitive to a 5% scaling error in one branch of that spectrum. In an ancillary effort, the thermal coefficient of expansion of AgCl was determined over the range 120-710K and the activation energy for Frankel defects was determined. Author (TAB)

**N69-37812#** Norwegian Defence Research Establishment, Kjeller.
**CURRENT SATURATION AND ELECTRON DRIFT MOBILITY IN ZnO**
Andreas Rannestad Dec 1968 18 p refs
(Contract AF 61(052)-958)
(AD-689184; NDRE-E-136; SR-5; AFCRL-69-0153) Avail: CFSTI CSCL 20/12

Acoustoelectric current saturation has been observed in the piezoelectric semiconductor ZnO. Complete current saturation is observed in one crystal from 242 degrees K to 300 degrees K. The threshold field obtained from the current-voltage characteristics has been used to determine the electron drift mobility, electron density and conductivity in the temperature range 77 degrees K to 500 degrees K. The experimental results show that the electron drift mobility is controlled by the lattice scattering at high temperatures and by traps at low temperatures. The electron density has an exponential temperature dependence with a change in the exponent at the maximum value for the electron drift mobility. The conductivity has an expected exponential temperature dependence with epsilon = 0.17 eV for two of the crystals and epsilon = 0.06 for one of the crystals. The last crystal shows a noticable deviation from the exponential dependence at high temperatures. Author (TAB)

**N69-37822#** Ballistic Research Labs., Aberdeen Proving Ground, Md.
**RESOLUTION OF STRESSES IN DEFORMATION TWINNING**
Priscilla W. Kingman Apr. 1969 25 p refs
(AD-689442; BRL-1433) Avail: CFSTI CSCL 20/2

Solutions for the maximum resolved shear stresses on twinning systems in fcc and bcc crystals in tension and compression are presented and discussed. Additional data are included on the relative magnitudes of shear stresses on secondary systems. Conventions for the specification of twinning systems are described and discussed. Author (TAB)

**N69-38001#** Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
**EPITAXIAL GROWTH MECHANISMS IN VACUUM DEPOSITED THIN FILMS Final Report, 1 Aug. 1962 – 31 Jul. 1968**
R. J. Gerdes and R. A. Young May 1969 14 p refs
(Contract Nonr -991(08))
(AD-689559; GIT-A-644-F) Avail: CFSTI CSCL 20/2

The mechenisms which lead to oriented overgrowth have been investigated with a view towards experimental and theoretical development of suitable models for nucleation and growth phenomena. Particular emphasis was placed on the role of common epitaxial features occurring independently of experimental conditions. Such features included the parallel alignment of close-packed rows of deposit atoms with <110> directions in the substrate, long-range epitaxial effects and crystallite size distributions characteristic of the various growth stages. Author (TAB)

**N69-38069#** Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
**PREPARATION AND STUDY OF THE PROPERTIES OF LEAD TELLURIDE AND CADMIUM TELLURIDE DIODES FOR USE IN NUCLEAR SPECTROMETRY [PREPARATION ET ETUDE DES PROPRIETES DE DIODES AU TELLURURE DE PLOMB ET AU TELLURURE DE CADMIUM EN VUE D'UNE UTILISATION EN SPECTROMETRIE NUCLEAIRE]**
René Lancon (Ph.D. Thesis-Grenoble Univ., 3 May 1968) Jul. 1969 98 p refs In FRENCH; ENGLISH summary
(CEA-R-3829) Avail: CFSTI

This report concerns the possibility of using high atomic number compound semiconductors, like lead telluride and cadmium telluride for nuclear radiation detectors, e.g. gamma ray spectrometry, because of their high absorption coefficients, and the problems related to the preparation of binary compounds are discussed. Experiments on PbTe show the influence of the conditions of preparation on the electrical properties of the semiconductor which are greatly dependent on the stoichiometry of the compound. PbTe surface-barrier diodes were used to study the surface properties of that semiconductor but these diodes cannot detect nuclear radiations because of the very weak resistivity of the material. Different types of CdTe devices have also been studied and

one of the diodes has been used as an alpha-particle detector. The relatively poor performances of that detector are probably due to the presence of lattice defects in CdTe where charge carriers can recombine. By analyzing the properties of gold diffused CdTe diodes this defect, the cadmium vacancy, was identified and is due to a deviation from stoichiometry during preparation. Author (ESRO)

**N69-38072*#** Stanford Univ., Calif. Dept. of Materials Science.
**MECHANISM OF THE PHOTOVOLTAIC EFFECT IN II-VI COMPOUNDS Progress Report, 1 Apr. – 30 Jun. 1969**
Richard H. Bube and P. F. Lindquist 30 Jun. 1969 30 p refs
(Grant NGR-05-020-214)
(NASA-CR-105971; SU-DMS-69-R-67; PR-5) Avail: CFSTI CSCL 20B

A systematic study of non-heat-treated single crystal $Cu_2S$–CdS heterojunctions has been initiated. In particular, the effects of $Cu_2S$ layer thickness and of CdS crystallographic orientation (A vs. B face) have been investigated. The basic mechanism of charge transport across the junction is a tunneling process, presumably through a conduction band spike. Major differences between A- and B-face behavior are found in the measurements of (1) growth rate of the $Cu_2S$ layer, (2) open-circuit voltage, (3) dependence of the slope of the C–V curve on layer thickness. The short-circuit current density decreases with increasing layer thickness for both A-and B-face samples, with A-face samples having the higher current density for thin layers. A possible interpretation of certain features of these data may be found in terms of a piezoelectric effect and of interface states. Author

**N69-38075*#** Battelle Memorial Inst., Columbus, Ohio.
**CREEP OF CoO SINGLE CRYSTALS**
A. H. Clauer, M. S. Seltzer, and B. A. Wilcox 29 Sep. 1969 55 p refs
(Grant NGR-36-002-070)
(NASA-CR-72590) Avail: CFSTI CSCL 20L

The CoO single crystals having a <100> axial orientation were creep tested in compression at oxygen pressures of $p_{O_2} = 10^{-4}$ atm to 1 atm. Tests were conducted over a temperature range of 1000° to 1200°C (0.60 - 0.71 $T_m$) and a stress range of 850 to 1700 psi. Sigmoidal (S-shaped) creep curves were observed. The dependence of the creep rate, at the inflection of the creep curve on temperature, stress and oxygen pressure was investigated. The activation energies for creep suggest that the creep rate is controlled by oxygen diffusion. The operative slip systems were {110}<110>. The creep substructure was studied by decoration of subboundaries by $Co_3O_4$ precipitate particles and by transmission electron microscopy. Regular arrays of subboundaries formed during creep. A significant fraction of these appeared to be tilt boundaries. The creep data obtained here were used to develop a qualitative picture of how CoO scales may creep during isothermal oxidation of Co. Author

**N69-38097#** McDonnell-Douglas Co., Huntington Beach, Calif. Douglas Advanced Research Labs.
**HOLOGRAPHIC OBSERVATION OF CRYSTAL GROWTH FROM THE MELT**
Raymond H. McFee May 1969 13 p refs *Its* Res. Commun. No. 101
Avail: CFSTI CSCL 20/2

A holographic recording technique is used to observe the interface morphology of transparent crystals during growth from the melt. Microscopic detail with spatial resolution of 300 line pairs/mm can be recorded within a volume several centimeters long by several millimeters in diameter. Author (TAB)

**N69-38110#** Oxford Univ. (England). Dept. of Theoretical Physics.
**DEFECTS IN CRYSTALS Final Technical Report, Jan. – Dec. 1968**
R. J. Elliott, K.-H. Timmesfeld, and M. F. Thorpe Jan. 1969 24 p refs
(Contract DAJA37-67-C-0444)
(AD-688961) Avail: CFSTI CSCL 20/12

Three rather separate projects related to the properties of defects in crystals have been pursued during the year. (1) The effect of defects on the thermal expansion of crystals. It has been shown that defects with low frequency resonances in the vibrational spectrum may show anomalously large thermal expansion at low temperatures which should be readily observable. The mean square displacement of such impurities is large and this accentuates the anharmonic properties. (2) Spin waves in a crystal containing point defects. The theory applicable at 0 degrees K when the magnetic moments are aligned is well established. Preliminary attempts have been made to extend this to T approximately equal to T sub c and T > T sub c, but a satisfactory theory has not been achieved. (3) Spin wave interactions in antiferromagnets. In the two magnon optical properties of antiferromagnets the spin waves are created close together and the interaction effects are accentuated. It has been shown that the observed spectra may be accounted for if these interactions are included. Author (TAB)

**N69-38146*#** Colorado Univ., Boulder. Dept. of Electrical Engineering.
**THE APPLICATION OF SEMICONDUCTORS TO QUASI-OPTICAL AND WAVEGUIDE ISOLATORS FOR USE AT MILLIMETER WAVELENGTHS**
R. E. Hayes, M. Kanda, G. Masciet, and W. G. May Jul. 1969 68 p refs
(Grant NGR-06-003-008)
(NASA-CR-105980) Avail: CFSTI CSCL 20L

An experimental and theoretical investigation of the utilization of anisotropic effects in semiconductor plasmas for the development of millimeter wavelength isolators is described. The topics reported on include a study of a quasi-optical isolator that depends on Faraday rotation in indium antimonide, and a study of a waveguide isolator employing several configurations of indium antimonide cylinders as a part of the guiding structure. All of the devices were operated at a frequency of 94 GHz and at a temperature of 75°K. Typical experimental results for the Faraday rotation devices were a forward insertion loss of about 1 db with an isolation of 9 db. Corresponding data for typical waveguide devices was about 2.5 to 5 db of forward loss and 20 to 30 db of isolation. It is concluded that devices of the type described for operation in the millimeter wavelength range must be cooled. At higher frequencies this may not be necessary. Author

**N69-38162#** Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.
**GERMANIUM: A BIBLIOGRAPHIC SUPPLEMENT Data Sheets**
M. Neuberger Mar. 1969 14 p refs
(Contract F33615-68-C-1225)
(AD-689752; DS-143-Suppl-4) Avail: CFSTI CSCL 20/12

An annotated bibliography is given in supplement of previous data. These data sheets describe the physical, chemical, and electrical properties of germanium. Radiation effects and life time measurements are included. E.H.W.

**N69-38243#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**TEMPERATURE DEPENDENCE OF THE ABSORPTION EDGE OF n-PbTe**
M. V. Kurik et al. [1969] 3 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 14, no. 7, 1969 p 1217–1219

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The temperature dependence of the shape of the n-PbTe absorption edge was determined, taking into account the effects of surface and volume defects in the crystal lattice. The experiment was performed using parallel plates cut from single crystals for the optical measurements. The sample surfaces were subjected to mechanical grinding and polishing; the free electron concentration was determined from measuring the Hall coefficient. A cryostat with a sample displacement mechanism was used for the temperature measurements, from which it was found that the frequency dependence of the n-PbTe absorption edge is described by an exponential function for all temperatures. The resultant frequency and temperature dependences of the absorption edge appear to correspond to direct optical transitions with the participation of phonons. A.C.R.

**N69-38286#** Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

**SPECTRAL INVESTIGATION OF ACOUSTOELECTRIC DOMAINS IN NGaAs BY MICROWAVE EMISSION STUDIES**

D. S. Zoroglu and I. C. Chang Jun. 1969 153 p refs

(Contract N00014-67-A-0226)

(AD-689517; TR-EE69-16) Avail: CFSTI CSCL 20/12

The experimental and theoretical study presented in this report pertains to the investigation of the spectral composition of acoustoelectric domains in semiconducting n-GaAs single crystals. The investigation is carried out by detecting, resolving and analyzing the electromagnetic radiation occurring from such domains. The experimental technique is the standard superheterodyning appropriate to microwave studies. TAB

**N69-38360#** Oak Ridge National Lab., Tenn. Office of Language Services.

**OPTICAL OBSERVATION OF LOSSES OF A SUPERCONDUCTOR IMMERSED IN LIQUID HELIUM**

M. Colombeau et al [1968] 4 p refs Transl. into ENGLISH from Rev. Phys. Appl. (France), v. 3, no. 1, Mar. 1968 p 18–20

Sponsored by AEC

(ORNL-tr-1979) Avail: CFSTI

An optical method is proposed by which small temperature differences between a superconducting sample fed with an ac current, and the liquid helium bath surrounding it may be observed. Author (NSA)

**N69-38364*#** Battelle Memorial Inst., Columbus, Ohio.

**AN ADVANCED THERMOELECTRIC LIFE TEST AND EVALUATION STUDY, PHASE 2 Final Report, 27 Dec. 1968–30 Jun. 1969**

30 Jun. 1969 41 p refs

(Contract NAS5-11644)

(NASA-CR-106012) Avail: CFSTI CSCL 20L

A test apparatus was designed and fabricated for the performance of thermoelectric couple life tests and efficiency measurements at constant thermal input power. Emphasis was placed on the development of the thermal insulation system in order to limit parasitic heat losses from the heat source to less than ~15 percent, hence simulating operating conditions typical of radioisotope-fueled thermoelectric generators. The apparatus was used to measure the energy-conversion efficiency of SiGe–PbTe segmented thermoelectric couples operating at cold- and hot-junction temperatures of 328°K (52°C) and 1200°K (927°C), respectively. The results of these measurements indicate that SiGe–PbTe segmented couples operating in this range are capable of conversion efficiencies of up to 9.8 percent, a significant improvement over either of these two thermoelectric materials operating individually. Author

**N69-38384*#** Norton Research Corp., Cambridge, Mass.

**RESEARCH AND DEVELOPMENT PROGRAM TO PRODUCE A SILICON CARBIDE COLD CATHODE (HOT ELECTRON) EMITTER Final Report, 21 May 1968–28 Feb. 1969**

R. M. Oman 28 Feb. 1969 58 p refs

(Contract NAS1-5347)

(NASA-CR-86796) Avail: CFSTI CSCL 20L

The advantages, theory, and several experimental investigations of hot electron emission are discussed. A hot electron emitter is defined as a solid state device that emits electrons excited to high energies in the solid so that the surface barrier can be overcome without any additional energy input. Its major advantage is that the emitting surface is at a low temperature and the power requirements are comparatively small. A simple model for a semiconductor junction, electron loss mechanisms in the transport region, and barrier penetration are specifically treated. Also included are a brief historical survey and description of the first experiments, as well as analysis of investigations aimed at reducing the thickness of the n-region and lowering the surface barrier. A.C.R.

**N69-38460#** Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

**ISOTOPIC RATIOS FOR PARTICLES REFERRING TO ONE ISOTOPIC MULTIPLET**

O. V. Dumbrais and M. I. Podgoretskii 1969 15 p refs In RUSSIAN

(JINR-P2-4382) Avail: AEC Depository Libraries

The processes, in which some final particles refer to one isotopic multiplet, are analyzed. The ratios are obtained between the cross sections or disintegration probabilities for configurations, which differ one from the other by the momentum commutation of the particles considered. Additional ratios are given for the case when some of isotopic amplitudes are small in comparison with the others. The obtained results may be of use both for the check of the selection rules and for the investigation of the reactions for which a direct measurement of the effective cross sections is difficult. Author (NSA)

**N69-38535#** Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

**ALPHA AND GAMMA SPECTROMETRY PRESENT STATE: FUTURE PESPECTIVE [SPECTROMETRIE DES RAYONNEMENTS ALPHA ET GAMMA ETAT ACTUEL: PERSPECTIVES D' AVENIR]**

A. Pascal 28 Jan. 1969 33 p refs In FRENCH Presented at the Conf. on Physrama, Marseille, 21 Oct. 1968

(CEA-CONF-1249) Avail: AEC Depository Libraries

The detection techniques used for $\alpha$ and $\gamma$ spectrometry are briefly outlined and properties of these radiations are reviewed. For fine structure $\alpha$ spectrometry grid ionization chambers and surface barrier semiconductors (semiconductor detectors) are the only two detectors presently used. Examples are given of the application of these detectors. In $\gamma$ spectrometry NaI(Tl) scintillators have been largely supplanted by Ge(Li) semiconductor detectors. Examples are given of the use of these detectors. Possible future developments in the detection of these two radiations are discussed. NSA

**N69-38541#** Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

**POSSIBILITIES AND LIMITATIONS OF ION IMPLANTATION INTO SEMICONDUCTORS**

Ph. Glotin 10 Dec. 1968 22 p refs Present at Conf. on Spec. Tech. for Semicond. as detectors, Lepre, Italy, 2 Oct. 1968

(CEA-CONF-1256; TN-LETI/EI-480; CONF-681049-1) Avail: AEC Depository Libraries

A review is presented of ion bombardment as a technique for doping semiconductors to make electronic devices. The channeling effect is discussed, and the effects of chemical impurities on the electric properties of the implanted layer are considered. The problems encountered in ion implantation can be overcome by

proper crystal alignment and thermal annealing. Implantations of phosphorus ions into silicon are considered as examples. It is concluded that ion implantation is a powerful technique along with diffusion. NSA

# 27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

**N69-37621#** Esso Research and Engineering Co., Linden, N.J. Government Research Lab.
**CONCEPTUAL DESIGN STUDY OF DEMULSIFICATION OF FUEL EMULSIONS BY A COALESCENCE PROCESS Final Report, Oct. 1967 – Oct. 1968**
William J. Asher Fort Eustis, Va. Army Aviation Materiel Labs. Apr. 1969 43 p refs
(Contract DAAJ02-68-C-0011)
(AD-688973; USAAVLABS-TR-69-16) Avail: CFSTI CSCL 21/4

It is desirable to have a demulsification process so that fuel recovered from safety fuel emulsions could then be used in devices or vehicles not qualified for emulsion fuel. The technical feasibility of all three essential steps was demonstrated: Breakdown of emulsion; Coalescence of unbroken emulsion; and the Separation of unbroken emulsion from the fuel. In this study, stainless-steel wool packing or screens were used for the critical steps of breaking and coalescing. Depending on the emulsions, 79 to 92% breakdown by weight was achieved. This performance was obtained by passing 1.4 gpm of the emulsions through a small tube containing the steel wool. The most important parameter determining the extent of breakdown was found to be the energy dissipated per unit volume of emulsion. The best breakdowns were obtained at the upper limit of energy dissipation of the equipment used. If this energy is increased either by operating at pressures greater than 240 psi or by using a recirculating system, the extent of emulsion breakdown should be increased. Continuous separation of broken emulsion was demonstrated. The resulting JP-4 met the military specifications with the exception of dissolved surfactant, which conventional testing procedures classified as gum. Although the surfactant was removed by adsorption on charcoal, it is questionable whether it represents a significant debit.
Author (TAB)

**N69-37760*#** Martin Marietta Corp., Denver, Colo.
**THE LITERATURE OF LOW-g PROPELLANT BEHAVIOR, 1966 TO 1969**
Thomas E. Bowman Sep. 1969 33 p refs
(Contract NAS9-8939)
(NASA-CR-101914; MCR-69-438) Avail: CFSTI CSCL 21I

A compilation of literature published during the period, 1966 – 1969, has been made from the spacecraft designer's point of view. Only the criteria of accessibility of the material and the investigation of low-g propellant behavior within the context of fluid mechanics have limited the selections. Brief discussion of reports that fall outside the main topics of investigation cover experimental techniques, cryogenic liquid flow, drop tower experiments, and orbital experimental means for studying basic liquid physical properties. Lenghty discussion of investigations is presented in the following subject areas: propellant location and interface shape, interface stability, reorientation, sloshing, propellant containment and ullage control, propellant withdrawal and resupply, bubbles and droplets, and heat transfer. M.H.E.

**N69-38172*#** Martin Marietta Corp., Denver, Colo.
**ADVANCED PROPELLANT MANAGEMENT SYSTEM FOR SPACECRAFT PROPULSION SYSTEMS. PHASE 2: DETAIL DESIGN**
Daniel L. Balzer, Thomas R. Barksdale, Thomas E. Bowman, Dennis E. Gilmore, David N. Gorman et al Sep. 1969 140 p refs
(Contract NAS9-8939)
(NASA-CR-101913; MCR-69-436) Avail: CFSTI CSCL 21I

A capillary propellant management system, recommended by the Phase I report as the only technique of sufficient merit to warrant further study, is described for conditions of no-hardware-change and no-hardware-limitations. Both analytical and experimental results are presented; the reference configuration was the Apollo spacecraft propulsion tankage. It was concluded: (1) Two propellant management systems designs are capable of meeting propulsion system requirements as specified. (2) The no-hardware-modification design can be retrofitted into the existing Apollo tankage. (3) The no-hardware-modification design meets Priority I and II system design goals, with the exception of using a 19 lb/tank as opposed to the goal of a 10 lb/tank. (4) The no-hardware-limitation design meets all goals, with the exception of the 11 lb/tank weight and the no-hardware-change goal which does not apply for this condition.
Author

**N69-38316#** Naval Ordnance Station, Indian Head, Md.
**APPLICATION OF ULTRASONIC ENERGY TO THE EXTRUSION OF FLUOROCARBON-BASE PROPELLANT. INDUSTRIAL PREPAREDNESS MEASURE FOR THE INDUSTRIAL RESOURCES DIVISION, ORD-047 Final Report**
J. E. Geist Apr. 1969 72 p
(AD-689783; NOW-IHTR-288) Avail: CFSTI CSCL 21/9.2

The report reviews a project for the extrusion of fluorocarbon propellants by the application of ultrasonic energy to the extrusion die. The project showed that the ultrasonic method increased the extrusion rate and improved the product homogeneity. In addition, it is expected that surface finish will be improved and the extrusion of nonsymmetrical sections will be feasible on a full-scale application.
Author (TAB)

# 28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

**N69-37207#** Battelle Memorial Inst., Columbus, Ohio.
**ADVANCED HIGH-SPEED FUEL PUMPS FOR SMALL GAS-TURBINE ENGINES Final Technical Report**
Harry T. Johnson and Robert K. Mitchell Ft. Eustis, Va. Army Aviation Mater. Labs. Apr. 1969 100 p refs
(Contract DAAJ02-67-C-0037)
(AD-688972; USSAVLABS-TR-69-12) Avail: CFSTI CSCL 21/5

The object of the program was to develop the technology necessary for vane-pump operation at turbine rotational speeds. Major hardware emphasis was devoted to the evaluation of a high-speed fuel pump based upon this technology. A single-lobe vane pump with a centrifugal charging stage was designed and successfully operated at 40,000 rpm pumping JP-4 turbine fuel. The vane pump relies upon the use of a hydrodynamically lubricated pivoting vane tip to support vane assembly radial loading. The hydrodynamic film allows a significant increase in tip surface speed without sacrificing the required endurance life. A 200-hour endurance run at speeds from 24,000 to 40,000 rpm was successfully completed with no noticeable performance degradation. Successful contamination experiments were performed after completion of 175 hours of the endurance schedule. The

contamination experiments were not extensive, but they verified that the design concepts were not unduly sensitive to contaminated fuel. Continued development will be required to establish life capability at the design pressure of 650 psig, but short-term capability was established at outlet pressures up to 600 psig. No major limitations with the basic pump design were found. The 50,000-rpm goal appears to be feasible, but further evaluation at speeds above 40,000 rpm was terminated due to bearing problems in the laboratory speed-increaser system. Author (TAB)

N69-37223*# TRW Systems, Redondo Beach, Calif. Mechanical Products Div.

**FINAL DESIGN AND QUALIFICATION OF A HYPERGOLIC ELECTRICAL POWER SYSTEM Final Report**

Aug. 1969 265 p refs

(Contract NAS9-8247)

(NASA-CR-101909; TRW-ER-7372) Avail: CFSTI CSCL 21H

The component and overall system design was evaluated and improvements were incorporated to provide a more trouble-free system. Electrical control system packages were designed for flight package adaptation utilizing modular construction techniques. Electrical system development testing was conducted. A closed loop lubrication system was designed, fabricated and tested. Modification of the method of introducing oil into the turboalternator bearings resulted in reduced friction and improved fuel consumption. The gas generator which had dual O/F ratio capability was further refined by decreasing the dribble volume. A design verification retest (DVR) unit was fabricated and tested. The test unit incorporated all of the Qualification Unit design concepts with the exception of the electrical subsystems. A model of the Qualification Unit was constructed for the purpose of aiding vehicle integration studies and flight package fabrication. Author

N69-37277*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.

**ATM OPTICAL CONTAMINATION STUDY: REACTION CONTROL SYSTEM ROCKET ENGINE SPACE PLUME FLOW FIELDS Interim Report**

B. A. Sodek and C. Y. Chou Apr. 1968 64 p refs Prepared for NASA, Marshall Space Flight Center

(NASA-CR-102240; RL-SSL-039) Avail: CFSTI CSCL 21H

Apollo telescope mount (ATM) experiments are threatened by the scattering, absorption, and deposition effects caused by a cloud of particles ejected from the ATM space complex. This report considers the necessary descriptions of such a contamination cloud and the contribution of reaction control system thrusters to the debris cloud. Author

N69-37548 National Lending Library for Science and Technology, Boston Spa (England).

**GAS TURBINES WITH PULSATING COMBUSTION CHAMBERS**

R. Marchal 28 Apr. 1969 19 p refs Transl. into ENGLISH from Entropie (Paris), no. 22, Jul.–Aug. 1968 p 15–19 In ENGLISH and FRENCH

(NLL-EE-Trans-1883-(3774.5)) Avail: Natl. Lending Library, Boston Spa, Engl.

An examination of the energy balance of gas turbines shows that the most important losses occur, not at the exhaust, but in the combustion chambers. The use of combustion chambers working in pulsating operation instead of the conventional chambers with steady operation enables these losses to be reduced. Theoretical examination of this gives an idea of the numerical magnitude. Some results obtained at the SNECMA are given at the end of the article. Author

N69-38018*# LTV Aerospace Corp., Dallas, Tex. Vought Aeronautics Div.

**DEVELOPMENT OF A TURBINE ENGINE INLET DEVICE FOR PROTECTION AGAINST BIRD INGESTION Final Report**

J. M. Metcalf Jul. 1969 89 p refs

(Contract FA-67-WA-1692)

(DS-69-9) Avail: Issuing Activity

Studies were made to determine and evaluate a number of concepts for protecting turbine engines from damage as a result of bird ingestion. A variety of concepts are reviewed ranging from incorporation of bird tolerant engine designs to installation of deflector grills inside or in front of the engine inlet duct. Descriptive comments are presented for each of the concepts studied. Static load/deflection test were performed with bird specimens to evaluate grill bar spacing and strength requirements for use in later tests. Bird specimens were impacted on a bare grill at 15° 30° and 45° inclination to the bird path. A simulated installed protective grill was then fabricated and subjected to bird impacts. Empirical relationships for the load developed on the grill inclination angle. Using the same grill design, tests were performed to evaluate the probable engine power losses associated with incorporation of the device into an airplane inlet duct. Subsequently, a flight test article was developed and submitted for further testing. Author

N69-38088*# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

**THEORETICAL FUNDAMENTALS OF CALCULATING THE STATIONARY PERFORMANCE CHARACTERISTICS OF TURBOJET ENGINES [THEORETISCHE GRUNDLAGEN ZUR VORAUSBERECHNUNG DES STATIONAEREN BETRIEBSVERHALTENS VON TURBOSTRAHLTRIEBWERKEN]**

G. Heise Apr. 1969 44 p refs In GERMAN

(Rept-69/2) Avail: CFSTI

The fields of the characteristic curves of a turbojet engine are calculated by means of an approximation method based on knowledge of the performance of the compressor and the turbine represented by a linear characteristic. The operation of a jet engine depends on the Mach number, flight altitude, and the speed of rotation. The calculation of the individual points of the curve can only be done by iteration, the number of cycles being equal to the number of free-running shafts in the engine. ESRO

N69-38193*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

**INDUSTRIAL SAFETY AT JET-ENGINE TESTING STATIONS AND LABORATORIES [BEZOPASNOST TRUDA NA ISPYTATELNYKH STANTSI STANTSIYAKH I V LABORATORIYAKH VOZDUSHNO-REAKTIVNYKH DVIGATELEI]**

L. I. Varlamov 19 Mar. 1969 91 p refs Translation into ENGLISH of Russian publ.

(AD-689208; FTD-HT-23-576-68) Avail: CFSTI CSCL 13/12

The organization and the equipment of stations and laboratories for testing air-breathing jet engines are discussed, and various testing methods and working conditions are described. Industrial safety measures and specifications and fire prevention methods are also presented. The book is intended for operators, technicians, and engineers engaged in jet engine testing. It may also be used by persons engaged in designing stations and laboratories for testing air-breathing jet engines. Author (TAB)

N69-38248*# Illinois Univ., Urbana. Charged Particle Research Lab.

**PRODUCTION OF HIGH CURRENT DENSITY ION BEAMS BY ELECTROHYDRODYNAMIC SPRAYING TECHNIQUES**

Donald Stephen Swatik May 1969 100 p refs

(Grant AF-AFOSR-1508-68)

(AD-689531; CPRL-3-69; AFOSR-69-1458TR) Avail: CFSTI CSCL 21/3

The production of high current density ion beams by the direct interaction of an intense electric field on a liquid surface was

investigated. Electrohydrodynamic spraying techniques, which have been traditionally utilized for the production of multi-molecular charged particle beams, were optimized for the production of ionic particles. Simultaneous ion formation and acceleration was achieved by applying a high DC voltage between a hemispherical liquid meniscus supported at the tip of a metallic capillary and a concentric, planer accelerating electrode. The field evaporated particles were analyzed to determine the usefulness of this technique as a source of charged particles for electrostatic microthrusters. The total emitted current, specific charge distribution of the emitted particle, and formation energy of the particles were measured in terms of the operating parameters of the system. Stable ion currents of up to 500 microamps were obtained from a single capillary emitter. The ion beam consisted of 75% gallium dimers, 24% indium dimers and 1% gallium tetramers. The resulting thrust produced was 73.8 micronewtons. Author (TAB)

**N69-38273*#** TRW Systems Group, Redondo Beach, Calif. Science and Technology Div.
**ADVANCED ROCKET ENGINE COOLING CONCEPT PROGRAM Final Report, Jul. 1968–Jan. 1969**
N. C. Rodewald and H. L. Burge Feb. 1969 140 p refs
(Contract NAS7-681)
(NASA-CR-72594) Avail: CFSTI CSCL 20H

The results and evaluations of an experimental investigation of the feasibility of an advanced cooling concept using liquid foams for film cooling of a rocket engine are presented. The experimental investigation consisted of laboratory tests to confirm the high pressure existence of water fire-fighting foams and amine foams, and heat transfer tests of the concept in 3000 $lb_f$ 300 psia heat sink and acrylic engines. In one test, a rocket engine 25.5 inches long was completely cooled to the saturation temperature of the coolant while maintaining a high coolant efficiency. It was concluded that foam has superior antistreaking characteristics and higher cooling capacities than its unfoamed liquid. Author

**N69-38590*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EXPERIMENTAL INVESTIGATION OF DYNAMIC DISTORTION IN A MACH 2.50 INLET WITH 60 PERCENT INTERNAL CONTRACTION AND ITS EFFECT ON TURBOJET STALL MARGIN**
James E. Calogeras Washington Oct. 1969 45 p refs
(NASA-TM-X-1842; E-5102) Avail: CFSTI CSCL 21H

The Lewis 10- by 10-foot supersonic wind tunnel of dynamic distortion within an inlet and of its effect on the stall margin of a J85-GE-13 turbojet engine was studied. Results indicate that average rms pressure fluctuations of 5 percent of the steady-state total pressure can completely degrade stall margin at certain engine speeds. Vortex generators were much more effective than throat bleed in suppressing dynamic distortion at off-design operating conditions. The presence of the engine appeared to have no effect on either the magnitude or the spatial distribution of dynamic distortion. Author

# 29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

**N69-37251*#** Volt Information Sciences, Inc., Lanham, Md.
**ON ANTIMATTER PENETRATION INTO THE SOLAR SYSTEM AND THE EARTH'S ATMOSPHERE**
V. A. Bronshteyn et al Greenbelt, Md. NASA: Goddard Space Flight Center 23 Sep. 1969 8 p refs Transl. into ENGLISH from Kosmich. Issled., Akad. Nauk SSSR (Moscow), v. 7, no. 4, 1969 p 597–601
(Contract NAS5-12487)
(NASA-CR-105829; ST-IM-10870) Avail: CFSTI CSCL 04A

The motion of hypothetical antibodies of the solar system and in the atmosphere of the earth is investigated. It is established that at collisions of antibodies with interplanetary gas and atmosphere atmoms, not only annihilation but also intensive antibody evaporation takes place, its specific energy being by 10 orders less than the specific energy of annihilation. As a result, at 1 atom/$cm^3$ density of interplanetary gas, an antibody with radius $r_0 \leq 1$ cm, cannot corse the solar system even once. At its entry into terrestrial atmosphere a sharp antibody deceleration takes place at the expense of the reactive pulsed radiation occuring at annihilation, as well as its evaporation, which will be completed for bodies of meteor dimension at altidues of 450–800 km. Author

**N69-37275#** Pennsylvania State Univ., University Park. Ionosphere Research Lab.
**BREMSSTRAHLUNG IN THE LOWER IONOSPHERE**
Gustav J. Freyer, III 15 May 1969 273 p refs
(Contract DAAD05-67-C-0642; Grant NSF GP-5611)
(AD-689458; SR-336) Avail: CFSTI CSCL 4/1

An aeronomic analysis is made of effective bremsstrahlung effects which are due to electrons penetrating into the upper atmosphere in the auroral zone. The electron attenuation in the atmosphere is determined from a Monte Carlo model which includes electron energy loss and scattering processes. A comparison is made between experimental results and the calculated energy deposition rates. Typical electron energy and angular distributions as a function of depth of penetration are given. Bremsstrahlung production rate profiles are obtained using the Bethe-Heitler cross sections which include the angular as well as the energy dependence. Numerical calculations are made of the ion production rates for a number of electron precipitation events which were observed. Electron energy distributions are obtained by suitably weighting basic calculations for 5, 10, 15, 25, 35, 50, 70, 100, 150, and 500 kev mono-energetic electrons. The bremsstrahlung ion production rates in the D region are found to be significant primarily for intense fluxes of 1 - 20 kev electrons usually associated with visible aurora. Author (TAB)

**N69-37380*#** Volt Information Sciences, Inc., Washington, D.C.
**INVESTIGATIONS OF THE SPECTRUM OF PROTONS IN THE INNER RADIATION BELT WITH THE AID OF AES COSMOS-137 [ISSLEDOVANIYE SPEKTROV PROTONOV VNUTRENNEGO RADIATSIONNOGO POYASA NA SPUTNIKE KOSMOS-137]**
I. A. Savenko et al Greenbelt, Md. NASA: Goddard Space Flight Center 23 Sep. 1969 11 p refs Transl. into ENGLISH from Cosmich. Issled., Akad. Nauk SSSR (Moscow), v. 7, no. 4, 1969 p 553–558
(Contract NAS5-12487)
(NASA-CR-105827; ST-PF-GM-10869) Avail: CFSTI CSCL 04A

The results of investigations are communicated of the spectrum of protons in the inner radiation belt with the aid of AES KOSMOS-137 on shells with L = 1.2–1.7, alongside with the spatial distribution of protons in the energy range 0.8–1000 Mev and in the plane of the geomagnetic equator. Comparison is made of the results obtained with those of other authors. Author

**N69-37881#** Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
**THE USE OF MULTIPLE RECEIVERS TO MEASURE THE WAVE CHARACTERISTICS OF VERY-LOW-FREQUENCY NOISE IN SPACE**
Stanley D. Shawhan Jun. 1969 96 p refs
(Rept-69-19) Avail: CFSTI

Until now most VLF radio noise experiments in the ionosphere, magnetosphere and solar wind have been able to provide only the amplitude and spectral characteristics of VLF phenomena. Experiments using multiple receivers to measure the amplitudes and relative phases of the magnetic and electric wave components, however, can give the wave characteristics in addition. Knowledge of both the spectral and the wave characteristics is desirable in making deductions about the noise source location and mechanism and about the properties of the propagation path. Expressions are derived for obtaining the electromagnetic wave characteristics, wave normal vector, Poynting vector and wave polarization, and the electrostatic wave characteristics, wave normal direction and field magnitude, from the amplitudes and relative phases of the wave components. The antenna systems capable of measuring the necessary wave components on payloads which are not spinning, spinning, or spinning and precessing are described. Consideration is given to the experimental technique of reducing payload interference, of transferring the required data to the ground and of obtaining the desired spatial, frequency, amplitude and phase resolution. The data obtained with such an experiment may represent the superposition of signals from multiple sources and multiple paths and from interference signals. Interpretation of these results is discussed and the use of the results of obtaining information on the source location and mechanism and on the propagation path properties is described. Recently several sounding rocket and satellite experiments capable of measuring some of the wave characteristics have been flown. The results concerning the wave normal directions for several different types of VLF noise phenomena are summarized. Author (ESRO)

**N69-37603#** Atomic Energy of Canada, Ltd., Chalk River (Ontario).
**COSMIC RAY NM-64 NEUTRON MONITOR DATA, PART 12**
J. F. Steljes May 1969 86 p refs
(AECL-3378) Avail: CFSTI; AEC Can., Ltd., $2.00

Uncorrected and barometric corrected results from the cosmic ray stations in Canada are given in tabular form. Data cover the period from January to April 1969. Normalized graphs are given for the data. The data for a flare increase on 25 February and a Forbush decrease at the end of April are given using a time resolution of five minutes. Author

**N69-37606*#** Bellcomm, Inc., Washington, D.C.
**EVIDENCE FOR THE EXISTENCE OF NEW PROCESSES AT ENERGIES ABOVE 2 TIMES 10 11 EV**
L. Kaufman and T. R. Mongan (MITRE Corp.) 10 Sep. 1969 35 p refs
(Contract NASw-417)
(NASA-CR-105923; TR-69-103-7-3) Avail: CFSTI CSCL 04A

Cosmic ray flux measurement in the energy region $10^{10}$–$10^{14}$eV obtained by calorimeters on the satellites, Proton I and II, have shown results that are at variance with previous data. While a single power law provides an approximate fit to the all-particle spectrum, the primary proton flux falls sharply at energies above $\sim 5 \times 10^{11}$ eV, indicating that at high energies protons become progressively scarcer in the primary flux. The cross section for particle production of protons on carbon is found to rise by 20% in the interval between $2 \times 10^{10}$ and $10^{12}$eV. The satellite flux measurements are explained by an energy loss mechanism in the calorimeter, with the loss being a function of the energy per nucleon, rather than total energy. Furthermore, this X process has a cross section of the right magnitude to account for the p-carbon cross section measurements. The X process could be described in terms of particle production or dissociation of the primary protons. Author

**N69-37689*#** Minnesota Univ., Minneapolis. Cosmic Ray Group.
**THE ACCELERATION AND PRECIPITATION OF VAN ALLEN OUTER ZONE ENERGETIC ELECTRONS**
George K. Parks Jun. 1969 87 p refs
(Contract NAS5-9542; Grant NSF GA-487)
(NASA-CR-105898; CR-138) Avail: CFSTI CSCL 04A

It is shown that the time profiles of trapped Van Allen electrons measured at synchronous altitudes and precipitated fluxes measured in the auroral zone are extremely well correlated. The freshly accelerated equatorial electrons are predominant in the 50-150 keV energies but when observed in 150-500 keV energies, they show different behavior. Equatorial electrons are created at all pitches but the pitch-angle distribution is peaked at 90°. The anisotropy in pitch-angle distribution increases and decreases with increasing and decreasing electron fluxes. Lifetime calculations from these simultaneous measurements show that typically, electrons during substorms have typical lifetimes of $\simeq 10^3$ seconds, but some events have lifetimes as short as $\simeq$200 seconds. The similarity of time profiles in precipitation and trapped fluxes, the differing behavior of $\simeq$50 and 150 keV electrons, the flat pitch-angle distribution, and the behavior of anisotropy are consistent with strong pitch-angle diffusion model of Kennel. Author

**N69-37704#** Atomic Energy of Canada, Ltd., Chalk River (Ontario).
**COSMIC RAY MT-64 MUON MONITOR DATA, PART 1**
J. F. Steljes Jul. 1969 90 p refs
(AECL-3413) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $2.00

Hourly rates corrected for atmospheric temperature and pressure from four cosmic ray stations in Canada which have muon monitors are given in tabular form by solar rotation for the period from the start-up of the monitors until the end of rotation 1812 (January 19, 1968). The Dorman–Maeda temperature correction factors for each station calculated at 12 hour intervals are also listed. Barometric pressures are available from neutron monitor data reports already published. Graphs of the relative hourly rates at each station are given. Author

**N69-37706#** Kiruna Geophysical Observatory (Sweden).
**FIRST RESULTS OF 1 AND 6 KEV PROTON MEASUREMENTS FROM THE ESRO I (AURORAE) SATELLITE**
W. Riedler and B. Hultqvist Jun. 1969 13 p refs Presented at the COSPAR Meeting, Prague, May 1969 Sponsored by Swed. Nat. Sci. Res. Council and Swed. Council for Appl. Res.
(KGO-698) Avail: CFSTI

The satellite ESRO 1 (Aurorae) was launched on Oct. 3, 1968 into a near-polar orbit and one of the onboard experiments (S.718) measures electrons and protons in the range from 1 to 13 keV in two directions relative to the earth's magnetic field. Results are given mainly from proton measurements at 1 and 6 keV, since no such long period measurements in the auroral zone have been reported hitherto. These results, obtained in the midnight to early-evening sector, show relatively smooth proton zones which mostly coincide with the sharply bordered electron zone. A strong anisotropy at the southern edge and isotropy within the zones is observed. Sometimes towards early evening a second softer proton zone north of the main one can be observed. Particularly high precipitation is reported on Feb. 2, 1969. Author (ESRO)

**N69-38029#** Naval Research Lab., Washington, D.C. Space Science Division.
**SOLAR X-RAY EMISSION DURING THE APOLLO 8, 21–28 DECEMBER 1968**
D. M. Horan, A. T. Mc Clinton, Jr., and R. W. Kreplin 13 Jun. 1969 22 p
(AD-689739; NRL-6917) Avail: CFSTI CSCL 3/2

Records of solar x-ray emission during the Apollo 8 manned lunar-orbiting mission show only one significant x-ray event. Comparison of this event with other large flares shows that it is completely overshadowed by two huge flares which occurred in July 1968. Events as large as those of July 1968 must be considered possible during the next year or two. Author (TAB)

N69-38080# American Science and Engineering, Inc., Cambridge, Mass.
**ANALYSIS OF SATELLITE DATA**
Daniel R. Parsignault, Frank R. Paolini, and George C. Theodoris 25 Mar. 1969 200 p refs
(Contract F19628-67-C-0277)
(AD-689409; ASE-2221; AFCRL-69-0183; SR-2) Avail: CFSTI CSCL 20/8

The report presents the results of the analysis of some data obtained from the satellite OV1-9 (1966-111A), theoretical work on the angular response of the electrostatic analyzer of the type flown on this satellite, and an empirical model for the earths radiation belts developed as a result of the analysis of the satellite data. The data analysis pertains to electron data, with E > 0.94 Mev, in the outer radiation belt of the earths magnetosphere. Author (TAB)

N69-38123*# Volt Technical Corp., Washington, D.C.
**ON THE POSSIBILITY OF INVESTIGATION OF PRIMARY COSMIC RADIATION BY TRACKS OF NUCLEAR PARTICLES IN METEORITES AND TEKTITES [O VOZMOZHNOSTI ISSLEDOVANIYA INTENSIVNOSTI PERVICHNOGO KOSMICHESKOGO IZLUCHENIYA PO TREKAM YADERNYKH CHASTITS V METEORITAKH I TEKTITAKH]**
L. L. Kesharov et al Greenbelt, Md. NASA. Goddard Space Flight Center 14 Jun. 1967 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Fiz. (Moscow), v. 30, no. 11, 1967 p 1790–1801
(Contract NAS5-12487)
(NASA-CR-105978; ST-IM-CR-10823) Avail: CFSTI CSCL 04A

It is shown that the investigation of primary cosmic radiation by the tracks of nuclear particles in meteorites and tektites is possible on the basis of the study of the depth of tracks and the results of measurements of the age of tektite hardening. Author

N69-38231*# Pittsburgh Univ., Pa. Space Research Coordination Center.
**EXCITATION AND RADIATIVE TRANSPORT OF OI 1340 ANGSTROM RESONANCE RADIATION. PART 1: THE DAYGLOW**
D. J. Strickland and T. M. Donahue 4 Sep. 1969 67 p refs
(Contract NASr-179)
(NASA-CR-105974; SRCC-101) Avail: CFSTI CSCL 04A

Radiative transfer theory is developed for the 1304 Å triplet of atomic oxygen which includes the effects of pure absorption by molecular oxygen and variability of the temperature governing the relative populations of the ground state $^3P_j$ levels. Starting from an essentially complete intensity-height profile for the dayglow, the initial source function or the production rate is determined. From the solution, the important dayglow excitation sources are derived. The solutions are shown to be sensitive to the following parameters: (1) the oscillator strength f, (2) the temperature governing the Doppler line width, (3) the temperature governing the $^3P_j$ levels, and (4) $O_2$ absorption below 130 km. Complete frequency redistribution is assumed and the basis of its validity is analyzed with regard to the given problem. A source is required in the F1 region whose strength is about 200 excitations per $cm^3$ per sec at 170 km. The altitude profile for the required source agrees well with those calculated for excitation of oxygen by suprathermal photoelectrons. Author

N69-38289*# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.
**VIBRATIONAL POPULATIONS OF HERZBERG I BAND OF MOLECULAR OXYGEN AND SYNTHETIC SPECTRA OF THE HERZBERG BANDS IN THE NIGHT AIRGLOW**
Vladimir Degen 20 Mar. 1969 25 p refs
(Grant NGL-06-003-082)
(NASA-CR-105969) Avail: CFSTI CSCL 04A

The relative vibrational populations of the $O_2$ ($A\ ^3\Sigma^+_u$) state in the nightglow have been determined for $0 < v' \leq 10$ by matching synthetic spectra of the Herzberg I bands to various published spectrograms. The synthetic spectra of the pure Herzberg bands obtained from this procedure are given at resolutions ranging from 1 Å to 25 Å. Author

N69-38489*# Volt Technical Corp., Washington, D.C.
**ELECTRONS OF NATURAL ORIGIN IN THE INNER RADIATION ZONE [ELEKTRONY YESTESTVENNOGO PROISKHOZHDENIYA VO VNYTRENNOY RADIATSIONNOY ZONE]**
V. V. Temnyy Greenbelt, Md. NASA. Goddard Space Flight Center 13 May 1968 12 p refs Transl. into ENGLISH from Kosmich. Issled. Akad. Nauk SSSR (Moscow), v. 6, no. 2, 1968 p 235–241
(Contract NAS5-12487)
(NASA-CR-105981; ST-PF-10713) Avail: CFSTI CSCL 04A

The characteristics of stationary electron distribution in the inner radiation zone, detected by several rockets and satellites, are discussed. The natural origin electrons were compared with artificial ones made by thermonuclear explosions. Models were used to predict and compare results. It was indicated in the measured data that the inner zone undergoes no significant temporal variations as the outer zone does. No analogous distribution of trapped electrons were obtained to this date. E.H.W.

# 30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-37211# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**SCIENCE, COSMONAUTICS, AND SOCIETY**
A. I. Sedov 1 Jan. 1969 63 p refs Transl. into ENGLISH from Nauka Kosmonavtika i Obshestvo (USSR), 1968 p 3–47
(AD-689306; FTD-HT-23-1200-68) Avail: CFSTI CSCL 22/1

Beginning with a chronological history of space exploration, covering the period 1957-66, in both the Soviet Union and USA, the author turns to a discussion of the mechanics of space flight. This section is followed by one on the philosophical aspects and social impact of space research. The final segment of the work is a biographical sketch of a Russian-Soviet engineer-educator-scientist. TAB

N69-37252*# Newcastle Univ. (Australia). Dept. of Physics.
**SOUTHERN HEMISPHERE METEOR RATES Final Report**
Colin S. L. Keay and C. D. Ellyett Dec. 1968 94 p refs
(Grant NGR-52-052-001)
(NASA-CR-105828) Avail: CFSTI CSCL 03A

The complete meteor rate data is presented from a controlled-parameter radar survey of meteor activity in the Southern Hemisphere. The survey extended continuously for 31 months from February 1963 until August 1965 inclusive. The data were very thoroughly screened and the meteor rates presented in tabular form cover almost 90 percent of the survey period. The tables contain a total of 2,304,333 meteors, an average of 114 per hour. The average diurnal variation in meteor activity is exactly similar to that obtained in an earlier survey in 1960/61 but some changes are evident in the annual variation. The various factors which influence the observed meteor rates are discussed. Author

N69-37283*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**TRAJECTORY AND PERFORMANCE**
James C. Stoll and Kenneth A. Adams *In its* Flight Performance of Atlas-Agena Launch Vehicles in Support of Lunar Orbiter Missions 3, 4, and 5 Aug. 1969 p 9–26 (See N69-37281 22-31)
Avail: CFSTI

Trajectory and performance results for the Atlas-Agena launch vehicle in the flights of Lunar Orbiters 3, 4, and 5 are presented. Data are included for the following phases: (1) liftoff through Atlas booster phase; (2) Atlas sustainer phase; (3) Atlas vernier phase; (4) Agena engine first-burn; (5) Agena second-burn; (6) Lunar Orbiter injection; and (7) postinjection and Agena retrosequence. The launch vehicle performed satisfactorily, with the exception of several minor problems, for all three missions. Lunar Orbiter injection was within the three sigma allowance, and the spacecraft then achieved its desired orbit and performed satisfactorily. A.C.R.

N69-37308# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astro Physics Lab.
**HIGH ENERGY X-RAYS FROM CYGNUS XR-1**
R. G. Bingham and C. D. Clark Dec. 1968 34 p refs
(AD-689091; D1-82-0782) Avail: CFSTI CSCL 3/2

X-rays from Cyg XR-1 were observed on 3 May 1967 over the energy interval 20 – 130 keV. The estimated primary photon intensity from the star confirms a recently reported high x-ray flux at about 30 keV during May 1967. The differential x-ray spectrum of Cyg XR-1 is probably not just a simple power law or exponential function; however, a black-body curve can be excluded. Author (TAB)

N69-37309# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astro Physics Lab.
**LUNAR THERMAL ANOMALIES AND INTERNAL HEATING**
J. M. Saari Jan. 1969 25 p refs
(AD-689040; D1-82-0809) Avail: CFSTI CSCL 3/1

The evidence for the existence of the so-called linear thermal anomaly recently reported on the western margin of Mare Humorum is examined critically and rejected. Whether the anomalous cooling of Mare Humorum considered as a whole can be caused by internal heating is also rejected on the basis of (1) the measured temperature differential compared to the environs observed during the lunar day, (2) the required temperature gradient, and (3) energy considerations compared to terrestrial heat flow. It is concluded that it is extremely doubtful that any of the observed hot spots are caused by internal heating. Author (TAB)

N69-37394# Liège Univ. (Belgium). Faculté des Sciences.
**CONTRIBUTION TO THE STUDY OF OSCILLATIONS AND STABILITY OF HOMOGENEOUS OR POLYTROPIC CONFIGURATIONS [CONTRIBUTIONS A L'ETUDE DES OSCILLATIONS ET DE LA STABILITE DES CONFIGURATIONS HOMOGENES OU POLYTROPIQUES]**
Henri Robe (Ph.D. Thesis) 1968 197 p refs In FRENCH
Avail: CFSTI

In the general case of a rotating star the solution of the oscillations leads to a set of non-separable differential equations and these can only be solved in particular cases such as Maclaurin or Jacobi ellipsoid. To help solve the problem, oscillations of a compressible cylindrical rotating polytrop are considered. The problem of the oscillations of a homogeneous incompressible mass $m_1$ submitted to tidal effects of a body $m_2$ is considered and solved; $m_1$ being non-rotational and $m_2$ in a fixed position. If $m_1$ and $m_2$ are orbiting in a circular orbit around the mutual center of gravity, the time of this revolution is equal to the period of rotation of $m_1$. ESRO

N69-37480# Belgian Observatory, Uccle.
**PHOTOSPHERIC AND SOLAR CHROMOSPHERIC OBSERVATIONS MADE AT UCCLE IN 1966 [OBSERVATIONS PHOTOSPHERIQUES ET CHROMOSPHERIQUES SOLAIRES FAITES A UCCLE EN 1966]**
1968 67 p In FRENCH *Its* Astron. Bull., Vol. VI, No. 5, 1967
Avail: CFSTI

The results of daily observations carried out at the Royal Observatory, Uccle, Belgium, in 1966 are presented in tabular form. Wolf numbers and data on sunspot evolution and solar activity obtained with a Zeiss heliograph and Lyot filters are listed. ESRO

N69-37485# Padua Univ. (Italy).
**FEASIBILITY OF COMBINED JUPITER FLY-BY AND OUT-OF-THE-ECLIPTIC MISSION**
G. Colombo Paris ESRO Dec. 1967 62 p refs
(ESRO-SN-15) Avail: CFSTI

The author, following Minovitch (1966) and V. C. Clarke (1966) considers only trajectories with a hyperbolic velocity (HEV) of 11 km/s, which requires an injection velocity from a low parking orbit (300 km altitude) of 15.6 km/s. For these trajectories the flight time from earth to Jupiter varies from 450 to 600 days. Taking into account a 5-year period for development, launch opportunities for 1972–1973 and, briefly, for 1974–1975 are reported. The author shows that, by changing the impact parameter of the probe with respect to Jupiter, it is possible to have a continuous set of trajectories with a postencounter velocity (relative to the sun) in the plane through the sun, normal to the ecliptic. Therefore, the postencounter trajectory may be a straight line directed towards the sun (earth-Jupiter-sun mission) or a postencounter trajectory normal to the ecliptic plane (earth-Jupiter out-of-ecliptic mission) with a different apsidal line and, therefore, a different maximum ecliptic latitude (as seen from the sun), a different perihelion distance, and a different total time length mission. A new set of missions (earth, Jupiter, out-of-ecliptic, sun mission) is also considered. It is shown that a mid-course guidance is critically important but that, in any case, with the present accuracy achievable (Mariner IV mars mission) the interest of the postencounter trajectory will not be significantly affected from possible mid-course correction errors. As regards conceptual spacecraft design studies, two unmanned spacecraft designs are reported following a study by Lally. One is light (650 lb), the other is much heavier (2500 lb). A set of feasible scientific experiments for investigation of Jupiter, as well as of the interplanetary medium, is listed. It is estimated that a net payload of the order of 1000 lb can be launched in any one of these trajectories by S1-B rocket with an extra kick stage. The spacecraft power may be provided by a SNAP generator. Such a mission may be accomplished within a period of 5 years. In conclusion, this study shows that a Jupiter mission appears to be entirely feasible and scientifically most useful. Author (ESRO)

N69-37470# Belgian Royal Observatory, Uccle.
**PHOTOSPHERIC AND SOLAR CHROMOSPHERIC OBSERVATIONS IN 1967 [OBSERVATIONS PHOTOSPHERIQUES ET CHROMOSPHERIQUES SOLAIRES EN 1967]**
C. Delye, G. Evrard-Kesteloot, and A. Koeksteinbergh 1968 67 p In FRENCH *Its* Astron. Bull., Vol. VI, No. 7, 1968
Avail: CFSTI

The results of daily observations carried out at the Royal Observatory, Uccle, Belgium, in 1967 are presented in tabular form. Wolf numbers and data on sunspot evolution and solar activity obtained with a Zeiss heliograph and Lyot filters are listed. ESRO

N69-37487# European Space Research Organization, Paris (France).
**SYNCHRONISM OF THE ROTATION AND ORBITAL MOTION OF PLANETS (MERCURY) AND SATELLITES [SYNCHRONISME DE LA ROTATION ET DU**

**MOUVEMENT ORBITAL DES PLANETES (MERCURE) ET DES SATELLITES]**
R. Pecsult May 1969 46 p refs In FRENCH; ENGLISH summary
(ESRO-SN-92) Avail: CFSTI

The recent measurement of the rotation period of the planet Mercury, equal to two-thirds of its revolution period, $T_0$, has given rise to a theoretical problem to which numerous works have already been devoted. In the present note, it has been assumed that a rigid body, planet or artificial satellite, moves on a Kepler orbit and revolves around an axis perpendicular to the orbital plane. The synchronism of the rotation with the orbital motion is systematically studied. First, the existence of such synchronous movements is proved mathematically; their periods are equal to $2\ T_0/n + 2$, n being an integer, and they are in phase with the orbital motion. Then, approximate solutions are computed. Finally, it is shown that only the movements corresponding to $n = 0$ (moon, satellites stabilized by gravity gradient), $n = 1$ (Mercury) and $n = 2$ are, in fact, sufficiently stable. Author (ESRO)

**N69-37503#** Institut d'Aeronomie Spatiale de Belgique, Brussels.
**AERONOMICAL PHENOMENA RELATED TO THE LUNAR FLIGHT OF APOLLO 8 [AERONOMISCHE VERSCHIJNSELEN VERBAND HOUDEND MET DE MAANREIS VAN APOLLO 8]**
E. Aerts and J. Vercheval 1969 14 p refs In DUTCH Submitted for publication /ts Aeronomica Acta No. A-60-1969
Avail: CFSTI

This text gives both an account of and an explication for the aeronomical phenomena observed in Belgium during the evening of December 21, 1968 in the constellation of the Eagle. Both phenomena are related to the journey to the moon of Apollo 8. Author (ESRO)

**N69-37536** National Lending Library for Science and Technology, Boston Spa (England).
**VARIATIONS OF THE CONTINUUM SPECTRAL DISTRIBUTION OF THE NIGHT AIRGLOW [VARIATSII SPEKTRALNOGO RASPREDELENIYA KONTINUUMA SVECHENIYA NOCHNOGO NEBA]**
Yu. L. Truttse Jul. 1969 19 p refs Transl. into ENGLISH from Rezultaty Issled. po Programme Mezhdunarodnogo Geofiz. Goda (USSR), sect. 4, no. 11, 1965 p 6–19
(NLL-RTS-5082) Avail: Natl. Lending Library, Boston Spa, Engl.: 35s

The continuum spectral distribution of the night airglow and its variations is of essential significance in determing the mechanism of continuum excitement. Moreover, sufficiently good knowledge of its spectral distribution is necessary for the correct estimation of the continuum in photoelectric observations of the discrete emissions of the night sky, separable by interference filters with a width of the equivalent full transmission band. Author

**N69-37542#** Boeing Scientific Research Labs., Seattle, Wash. Geo-Astro Physics Lab.
**INFRARED OBSERVATION OF THE ECLIPSED MOON**
R. W. Shorthill and J. M. Saari Jan. 1969 86 p Submitted for publication
(AD-689076; D1-82-0776) Avail: CFSTI CSCL 3/2

At the time of the present document, the most extensive mapping of the lunar surface in the far infrared has been accomplished during the 19 December 1964 eclipse. The present report is confined to a brief description of these measurements and presents several examples of the various methods used for analyzing the data. The thermal contours obtained from one of the scan programs obtained during totality are displayed. Some of the general characteristics of the anomalies noted are presented. Author (TAB)

**N69-37572*#** TRW Systems Group, Redondo Beach, Calif.
**MISSION ORIENTED STUDY OF ADVANCED NUCLEAR SYSTEM PARAMETERS, PHASE 6. VOLUME 1: SUMMARY TECHNICAL REPORT Final Report**
A. R. Chovit, G. M. Callies, and R. D. Kennedy Jan. 1968 43 p refs
(Contract NAS8-5371)
(NASA-CR-102247; TRW-01977-8025-R0-00) Avail: CFSTI CSCL 22A

A summary is given of the study approach and basic guidelines and assumptions used in a series of analyses of manned Mars lander and manned Mars and Venus orbital capture (no manned lander) missions. Analyses were performed for Mars missions employing opposition class, Venus swingby, and conjunction class trajectories for launch opportunities from 1980 through 1993. The Venus missions employed inferior conjunction class trajectories for launch opportunities from 1980 through 1985. The investigations included comparative analyses of vehicles using cryogenic chemical, liquid storable, and nuclear rocket propulsion systems. Nuclear rocket thrust levels of 75,000, 100,000 and 200,000 lb were analyzed. Both circular and elliptic Mars parking orbits were investigated, and an analysis of Earth and Mars launch window requirements was made for selected missions. A summary of the analyses and results is presented as well as an evaluation and recommendations based on the results. Author

**N69-37615*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A DESCRIPTION OF POSITION ANGLES FROM THE HODOGRAPH OF A CENTRAL FIELD MOTION**
J. B. Eades, Jr. Sep. 1969 41 p refs Submitted for publication
(NASA-TM-X-63675; X-643-69-391) Avail: CFSTI CSCL 22C

The velocity hodograph, representing a two-body motion, can be used in the development of analytic relations which are descriptive of this category of central field trajectories. A brief vector development is presented which leads directly to the two principal velocity hodograph representations; namely, the classical hodograph and the special hodograph. As an example of the utility of these representations a geometric description of, and correlation between, the several position angles of reference (true, eccentric, and mean anomalies) is developed, as appropriate. Author

**N69-37691#** Instito y Observatorio Astronomico de Marina, San Fernando (Spain).
**NAUTICAL ALMANAC FOR 1970 [ALMANAQUE NAUTICO ANO 1970]**
1969 428 p In SPANISH
Avail: CFSTI

The Nautical Almanac for marine navigation use in 1970 is presented with the hour angle listed for the Sun, Moon, Venus, Jupiter, Saturn, and the First Point of Aries for each hourly increment of Greenwich Civil time. The sideral angle, and declination for 97 of the commonly used navigation stars are given, and the phases of the moon are tabulated. Examples for extracting and correcting data are shown, and a time correction chart for using these tabulated values through 1971 is included. Transl. by F.O.S.

**N69-37697*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**AN ANALYSIS OF THE DISTRIBUTION OF BOULDERS IN THE VICINITY OF SMALL LUNAR CRATERS**
Winifred Sawtell Cameron and George J. Coyle Aug. 1969 44 p refs Submitted for publication
(NASA-TM-X-63672; X-641-69-369) Avail: CFSTI CSCL 03B

A survey of boulder distributions inside and around small (0.11-2km) craters was made to investigate statistically a casual impression that there were distinct differences. Several frames from Lunar Orbiter III high resolution (1 meter) photographs in three separate regions of the moon were inspected with a magnifying lens for craters with diameters $\geq$ 110 meters. Below this limit boulders were difficult to detect. Originally 200 m had been adopted as the

lower diameter limit but this yielded too few typical impact craters. The extended survey yielded a total of 803 craters from 9 frames. Classification and distribution of boulders outside and within the craters indicated that there are at least two populations of primary craters with different origins. Some evolved under considerable energy and pulverized the lunar terrain into numerous blocks dispersing them to great distances; the others showed considerable weaker energies and threw boulders only to the confines of the crater. The former are classified as impact craters and the latter as of internal origin. Author

**N69-37728#** Radio and Space Research Station, Slough (England).
**KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FROM MALTA FOR SEPTEMBER 1967, PART 1**
1968 95 p *Its* Issue No. 2
Avail: CFSTI

Measurements of satellite orbits are recorded from the Malta space research station in cinetheodolite observations. Iota 1 (1960), Beta Tau 6 (1962), 03A and 30D (1963) data were recorded for the entire month of September 1967. M.H.E.

**N69-37729#** Radio and Space Research Station, Slough (England).
**KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FROM MALTA FOR SEPTEMBER 1967, PART 2**
1968 93 p *Its* No. 2
Avail: CFSTI

Measurements of satellite orbits are recorded from the Malta space research station in cinetheodolite observations: 43A and 53A (1963), 04A and 53A (1964), and 11D, 14A, and 14B (1965) data were recorded for the entire month of September 1967. M.H.E.

**N69-37730#** Radio and Space Research Station, Slough (England).
**KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUPS FROM MALTA FOR SEPTEMBER 1967, PART 3**
1968 70 p *Its* Issue No. 2
Avail: CFSTI

Measurements of satellite orbits and unknown objects are recorded from the Malta space research station in cinetheololite observations. The HHA, HHB, 56A, and 117B (1966), 19B, and 88B (1967), and unknown objects were observed for the month of September 1967. The largest number of data describe Pageos 1 satellite. M.H.E.

**N69-37777*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**TABULATIONS OF CONFIGURATION FACTORS BETWEEN ANY TWO SPHERES AND THEIR PARTS**
Norman T. Grier Washington 1969 424 p refs
(NASA-SP-3050) Avail: CFSTI CSCL 12A

Tables of values of the configuration factors between two spheres, between parts of one sphere and parts of another sphere, and between a point on one sphere and parts of another sphere are presented. The parts are areas that subtend angles that are multiples of 15° in both the colatitudinal and longitudinal directions. The equations are derived in the biospherical coordinate system. Values are presented for the ratio of radii $r_2/r_1$ of the spheres from 0.01 to 1.00. The distance between centers of spheres was varied from $(1.001 + r_2/r_1)r_1$ to $100r_1$, where $r_1$ is the radius of the larger sphere. Conditions corresponding to the earth - moon situation are also included in the calculations. Author

**N69-37778#** Royal Observatory, Edinburgh (Scotland).
**THE ABSOLUTE CALIBRATION OF ROCKET-BORNE STELLAR PHOTOMETERS IN THE REGION 2000-3000 ANGSTROM**
J. W. Campbell 1968 9 p refs Presented at the Symp. on Calibration Methods in the Ultraviolet and X-ray Regions of the Spectrum, Munich, 1968 *Its* Commun. no. 61
Avail: CFSTI

The laboratory procedures in calibrating four stellar photometers recently flown in the ESRO program were described. These instruments were aimed at obtaining absolute stellar radiation fluxes in the region 2000 to 3000 Å with a resolution of 200 Å. Such procedures include the measurement of spectral response, quantum efficiency, and cathode uniformity for a variety of solar blind photomultipliers. A comparison is also made between the use of the standard detector and the standard source techniques. Author

**N69-37806*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**LUNAR GRAVITY FIELDS DETERMINED FROM APOLLO 8 TRACKING DATA**
T. L. Felsentreger, J. P. Murphy, J. W. Ryan, and L. M. Sater Jul. 1969 104 p refs
(NASA-TM-X-63666; X-552-69-317) Avail: CFSTI CSCL 22C

Tracking data from the eight near-circular lunar orbits made by the Apollo 8 spacecraft were analyzed in an attempt to determine spherical harmonic lunar gravity models suitable for use in future Apollo missions. Thirty-one determinations through degree and order six are presented, in addition to test and evaluation results of many of the models. Author

**N69-37893*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**PLANETARY EFFECTS IN THE MOTION OF NATURAL SATELLITES**
Peter Musen Washington Oct. 1969 28 p refs
(NASA-TN-D-5284) Avail: CFSTI CSCL 03C

Addition of the direct and indirect planetary perturbations to the author's 1963 modification of Hansen's theory is proposed. The method described can determine the Saturnian effects upon the motion of the outer Jovian satellites. The expansion of the disturbing function and of its derivatives is reduced to a form convenient for programming. Author

**N69-37942*#** Geological Survey, Flagstaff, Ariz. Center of Astrogeology.
**ASTROGEOLOGIC STUDIES: LUNAR GEOLOGIC SURVEY**
[1968] 71 p refs
(NASA Order R-66)
(NASA-CR-105838) Avail: CFSTI CSCL 03B

Three preliminary geologic maps of the lunar surface describe the Schiller quadrangle, the Clavius quadrangle, and the Hommel quadrangle. The maps at this state are a result of data derived from Lunar Orbiter photographs, geophysical observatories, astronautical observatories, visual observation, and aeronautical charts. Explanatory pamphlets which accompany the maps delineate the geological setting of each quadrangle, the stratigraphy, the general geological structure, the geological history, crater morphologies, and a list of published reference data. M.H.E.

**N69-37960#** Osservatorio Astrofisico di Arcetri, Florence (Italy).
**OBSERVATIONS AND MEMORANDA, NUMBER 89 [OSSERVAZIONI E MEMORIE FASCICOLO 89]**
Partly in ENGLISH and partly in ITALIAN 1968 81 p refs
Avail: CFSTI

CONTENTS:

1. THE SOURCES OF RADIATION IN THE REGION 1-2000A. A. M. Cantu, M. Landini, and G. Noci p 5-39 refs (See N69-37961 22-30)

2. MODELS OF SOLAR CHROMOSPHERE AND CORONA AND THE 21- cm HYDROGEN LINE IN THE SOLAR SPECTRUM A. M. Cantù, I. G. Drago and G. Noci p 41-58 refs (See N69-37962 22-30)

3. SOLUTION OF LINE TRANSFER EQUATION AND INFORMATION CONTAINED IN A LINE PROFILE G. Noci p 59-64 refs (See N69-37963 22-30)

**N69-37961#** Osservatorio Astrofisico di Arcetri, Florence (Italy).
**THE SOURCES OF RADIATION IN THE REGION 1-2000Å [LE SORGENTI DI RADIAZIONE NELL'INTERVALLO SPETTRALE 1Å-2000Å]**
A. M. Cantu, M. Landini, and G. Noci *In its* Observations and Mem. No. 89 1969 p 5-39 refs (See N69-37960 22-30)
In ITALIAN; ENGLISH summary
Avail: CFSTI

The main types of sources of radiation in the region 1-1000 Å are reviewed. The sources are classified under three categories: (1) sparks, (2) discharge tubes, (3) X-ray tubes. Among the discharge tubes, the Geissler tube, the hollow cathode discharge tube, the Kyman source and the microwave stimulated sources. Among the X-ray tubes, the gas tubes (cold cathode) and the Coolidge tubes (hot cathode), with some types of linear focus and rotating anticathodes. Importance is attached to stability, reproducibility and absolute calibration, in order to use those sources as laboratory standards. At the end a brief description is given of other kinds of sources such as thatatrons, laser generated plasmas, Cerenkov sources and exploding wires. Author (ESRO)

**N69-37962#** Osservatorio Astrofisico di Arcetri, Florence (Italy).
**MODELS OF SOLAR CHROMOSPHERE AND CORONA AND THE 21- cm HYDROGEN LINE IN THE SOLAR SPECTRUM**
A. M. Cantù, F. G. Drago, and G. Noci *In its* Observations and Mem., No. 89 1969 p 41-58 refs (See N69-37960 22-30)
(Contract AF 61(052)-67-C-0042)
Avail: CFSTI

This paper deals with the possibility of detecting the 21-cm hydrogen line in the spectru,spectrum of the quiet sun and of a prominence. The transfer equation for continuum and the line emission is discussed and a method to calculate the ray paths in a spherical symmetrical one is found to be inconsistent with the observational data. The line intensity is calculated and it is shown that the line cannot be detected either in the quiet sun radiation (as already known) or in the emission from a prominence. Author (ESRO)

**N69-37963#** Osservatorio Astrofisico di Arcetri, Florence (Italy).
**SOLUTION OF LINE TRANSFER EQUATION AND INFORMATION CONTAINED IN A LINE PROFILE**
G. Noci *In its* Observations and Mem., No. 89 1969 p 59-64 refs (See N69-37960 22-30)
Avail: CFSTI

This paper investigates the transfer of radiation in conditions holding for many chromospheric lines. The hypothesis of constant absorption profile along the ray path is made. Using suitable transformations of the coordinate wavelength and depth, the equation of transfer is solved by Fourier transformation. The effect of observational errors on the information contained in a line profile is discussed and a measure of such information obtained. Author (ESRO)

**N69-37983*#** California Inst. of Tech., Pasadena. Div. of Physics, Mathematics and Astronomy.
**TWO-MICRON SKY SURVEY: A PRELIMINARY CATALOG**
G. Neugebauer and R. B. Leighton Washington NASA Aug. 1969 316 p refs Revised
(Grant NGL-05-002-007)
(NASA-SP-3047-Rev) Avail: CFSTI CSCL 03B

In 1965 an infrared sky survey was initiated. The purpose of the survey was to obtain an unbiased sample of celestial objects that emit in the infrared region and to study their characteristics. Such properties as apparent intensities, colors, variability, and spatial distributions were of primary interest. In addition, it was expected that objects having extreme redness might be found and, if so, would be of great interest. This catalog contains a complete listing of all objects detected on the survey that had a flux density at 2.2$\mu$ exceeding approximately $4 \times 10^{-25}$ $Wm^{-2}Hz^{-1}$. The data were obtained from January 30, 1965, through April 7, 1968. Because of the limitations in the telescope mounting, the northern limit of the survey was set at plus 81°. The southern limit of minus 33° was set to include the region of the galactic center at minus 30°. Objects at minus 33° are observed through an air mass of 2.58; the extinction effects on observations further to the south become prohibitive. Author

**N69-38040*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**A DISCUSSION OF ORBITAL WORKSHOP ORIENTATION AND GRAVITATIONAL EFFECTS**
Billy G. Davis 5 May 1969 105 p refs
(NASA-TM-X-53829; Rept-53829) Avail: CFSTI CSCL 22C

This report contains the equations necessary to evaluate the energy requirements due to gravitational effects for several selected orientations. First, the basic gravity gradient torque equations are derived in general form, after which various coordinate systems are defined that related the local gravity gradient vector to the spacecraft's control axes. Then the equations are evaluated for several selected attitude hold modes as solar-fixed and orbit-fixed. Finally, using fixed-time-of-year analyses and neglecting orbital regression, the energy requirements necessary for attitude hold against gravity gradient torques are summarized for the selected attitude hold modes. The material presented can be easily adapted for use in evaluating additional attitude hold orientations and utilized for quick-look analysis of orbital orientation and its impact on preliminary spacecraft design, especially the control system. Author

**N69-38066#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**DYNAMICS OF PROBE DESCENT IN PLANET ATMOSPHERES AS A MEANS OF CHECKING MEASUREMENT DATA**
A. M. Obukhov et al 1969 8 p refs Transl. into ENGLISH from Kosmich Issled. (Moscow), v. 7, no. 1, 1969 p 150-155
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method is proposed for checking the mutual agreement between measurements of the pressure, density, and temperature from probes descending by parachute in planet atmospheres. Underlying this method is utilization of the hydrostatic and dynamic equations of the probe's descent, as well as the equation of state in some cases. As an illustration, data obtained on the Soviet Venera-4 probe are utilized. This method shows good mutual agreement between all the quantities measured. The empirically determined matching constants can be used to extrapolate data, of the pressure and density, even to those portions of the descent trajectory where only one parameter, the temperature, was measured, as was done on the Venera-4. The final value of the pressure thus extrapolated turns out to be equal to 17.6 ± 0.5 $kg/cm^2$. It is shown that utilization of the coordinates at the appropriate times will afford a possibility of estimating the temperature stratification of the atmosphere. Author

**N69-38145*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**A UNIFIED TREATMENT OF LUNAR THEORY AND ARTIFICIAL SATELLITE THEORY**

William A. Mersman Washington Oct. 1969 38 p refs
(NASA-TN-D-5459) Avail: CFSTI CSCL 12A

Lunar theory and artificial satellite theory are treated by a unified method that is a generalization of the von Zaipel procedure. The technique of separation of variables is used to generate a single canonical transformation that eliminates the time and all the angle variables from the Hamiltonian. The validity of the method is established and the calculations are carried far enough to illustrate the techniques involved. Author

N69-38160# Defence Research Board, Ottawa (Ontario). Defence Scientific Information Service.
**SPECTRAL INHOMOGENEITIES OF THE LUNAR SURFACE IN THE MIDDLE ULTRAVIOLET, FROM THE DATA OF AUTOMATIC INTERPLANETARY STATION ZOND 3**
M. U. Aganina et al May 1969 7 p refs Transl. into ENGLISH from Astron. Vestn. (USSR), v. 3, no. 1, 1969 p 14–17
(AD-689802; T-520-R) Avail: CFSTI CSCL 3/2

The paper describes color inhomogeneities of the far side of the Moon, using measurements made from Automatic Interplanetary Station Zond 3. The investigated region of the Moon subdivides, according to mean brightness, into three distinct fields. The maximal color contrasts between individual areas studied amount to 24%; the mean color-contrasts 10%. Author (TAB)

N69-38218# Queen Mary Coll., London (England).
**PLASMA PHYSICS IN AN ASTROPHYSICAL ENVIRONMENT Final Scientific Report, 15 Nov. 1968–14 Nov. 1968**
Ian W. Roxburgh Jan. 1969 14 p refs
(Contract F61052-67-C-0019)
(AD-689579; AFCRL-69-0134) Avail: CFSTI CSCL 3/2

Problems involving the stability and equilibrium of astrophysical systems have been investigated, particularly the structure of rotating turbulent convective zones and the effect of rotation of the shape of a star. It has been shown that the rotational interference with convection can produce an oblateness and drive meridional circulation which produces equatorial acceleration. The effect of circulation in the surface layers of the sun on the observed flux from equator and pole have shown that the results obtained by Dicke do not necessarily imply a large quadrupole moment for the sun. The deep ionisation zones to be expected in very large giants have been shown to give rise to dynamical instabilities leading to the ejection of large amounts of mass, as is observed in planetary nebulae. Author (TAB)

N69-38284*# Naval Research Lab., Washington, D.C. E. O. Hulburt Center for Space Research.
**NEW DISCOVERIES IN SPACE SCIENCE AT NRL DURING THE PAST YEAR Annual Report, Fiscal Year 1969**
Herbert Friedman 1 Jul. 1969 177 p refs
(NASA Order R-09-029-063)
(NASA-CR-105970) Avail: CFSTI CSCL 04A

Presented is a list of the most noteworthy results from the scientific flight program. The two most remarkable discoveries, those of the emission from galactic water vapor by maser action, and of the X-ray pulsar in the Crab Nebula, were made from the earth's surface and from a sounding rocket, respectively. The satellite programs mostly provided monitoring or surveys of new phenomena of grand spatial extent. G.G.

N69-38363*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ROUND TRIP TRAJECTORIES WITH STOPOVERS AT BOTH MARS AND VENUS**
E. A. Willis, Jr. and J. A. Pedrutt 1969 12 p refs
(NASA-TM-X-52680) Avail: CFSTI CSCL 22C

Round trip interplanetary trajectories are studied that stop over at both Mars and Venus before returning to earth. Such trips fall roughly midway between conventional opposition, and conjunction, class Mars missions, in terms of propulsive effort, trip time and staytime. Author

N69-38470# RAND Corp., Santa Monica, Calif.
**CREATION OF AN ATMOSPHERE FOR THE MOON**
L. Marshall Libby Jun. 1969 6 p refs
(P-4132) Avail: CFSTI CSCL 3/2

The report describes a method of creating a lunar atmosphere. If the lunar crust were deliberately and methodically broken, simulating earthquake and volcanic activity on the planets, some of the stored gases and vapors could be released and would form a lunar atmosphere. TAB

N69-38480*# Volt Information Sciences, Inc., Washington, D.C.
**ESTIMATES OF BOUNDARY LAYER PARAMETERS IN PLANETARY ATMOSPHERES OF THE TERRESTRIAL GROUP**
G. S. Golitsyn Greenbelt, Md. NASA. Goddard Space Flight Center 26 Sep. 1969 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana (Moscow), v. 5, no. 8, 1969 p 775–781
(Contract NAS5-12487)
(NASA-CR-105982; ST-RA-10871) Avail: CFSTI CSCL 03B

The similarity theory of atmosphere boundary layer is applied to the estimate of the form of vertical profiles of average wind velocity and potential temperature in the atmospheres of planets of the terrestrial group in day and nighttime conditions. It is considered, as also for the earth, that the magnitude of the turbulent heat flow $q_T$ in daytime is about 0.1 of $q(1-A)$, where $q$ is the solar constant for the planet A is its albedo, and in nighttime $q_T$ is still by several factors less. The dynamic velocity $U^*$ is taken equal to 2 – 5 percent (depending upon the stratification) of the mean wind velocity in the free atmosphere. The boundary layers in the atmospheres of Mars and Venus and in the hypothetical atmosphere of Mercury are examined in detail. Sharp temperature drops are characteristic of Mars within the bounds of a few tens of meters, attaining several tens of degrees, which is caused by the low density of its atmosphere. For Venus, owing to very high atmosphere density, the stratification is close to neutral, and the temperature profile is close to the adiabatic one. Owing to high winds, the stratification on Mercury must also be close to neutral with respect to the wind, but because of low density such temperature drops may be very great. Author

## 31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-37281*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**FLIGHT PERFORMANCE OF ATLAS-AGENA LAUNCH VEHICLES IN SUPPORT OF THE LUNAR ORBITER MISSIONS 3, 4, AND 5**
Washington Aug. 1969 140 p refs
(NASA-TM-X-1859) Avail: CFSTI CSCL 22B

Performance evaluations are presented for the last three of five successful Atlas-Agena vehicles, launched from the Eastern Test Range in support of the Lunar Orbiter series of photographic and selenographic missions. These flights were so similar that results are combined into a single report. Lunar Orbiter III was launched February 5, 1967 (referenced to GMT), followed by Lunar Orbiter IV on May 4, 1967, and Lunar Orbiter V on August 1, 1967. All three flights used a similar mode of ascent wherein the Atlas boosted the Agena-Lunar Orbiter into a proper suborbital coast ellipse. After separation of the Agena spacecraft from the

Atlas, the Agena engine was started and the Agena-spacecraft was injected into the desired approximate 185-kilometer circular parking orbit. After an orbital coast period, the Agena engine was restarted, and the spacecraft was injected into the lunar transfer trajectory. Insertion of the spacecraft into the translunar trajectories was very accurate. Out of the allocated 75-meter-per-second spacecraft midcourse correction capability, only 3.3 meters-per-second would have been required for Lunar Orbiter III, 10.8 for Lunar Orbiter IV, and 19.5 for Lunar Orbiter V to place the spacecraft onto the proper trajectory for the spacecraft deboost into its initial orbit around the moon. All three Lunar Orbiters successfully achieved the desired lunar orbits. For individual titles see N69-37281 – N69-37286. Author

**N69-37282*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**LAUNCH VEHICLE DESCRIPTION**
Joseph A. Ziemianski and Eugene E. Coffey *In its* Flight Performance of Atlas-Agena Launch Vehicles in Support of Lunar Orbiter Missions 3, 4, and 5 Aug. 1969 p 5–8 (See N69-37281 22-31)
Avail: CFSTI CSCL 22D

The Atlas-Agena launch vehicle, a two and one-half stage vehicle consisting of an Atlas first and one-half stage and an Agena second stage connected by a booster adapter, is briefly described. Its physical dimensions, propulsion system, flight control, and release from the primary spacecraft are mentioned. A.C.R.

**N69-37284*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ATLAS VEHICLE SYSTEM PERFORMANCE**
*In its* Flight Performance of Atlas-Agena Launch Vehicles in Support of Lunar Orbiter Missions 3, 4, and 5 Aug. 1969 p 27–69 See N69-37281 22-31)
Avail: CFSTI CSCL 22B

Specific Atlas systems are described, and performance data are given for the flights of Lunar Orbiters 3, 4, and 5. Included are: (1) vehicle structure system, consisting of propellant tank section and booster engine section; (2) propulsion system, including booster engine, sustainer engine, two vernier engines, an engine tank system, and an electrical control system; (3) propellant utilization system designed to cause near simultaneous depletion of both propellants; (4) hydraulic system with independent booster and sustainer-vernier systems; (5) pneumatic system to supply helium gas for tank pressurization and for various vehicle control functions; (6) guidance and flight control system using two interrelated flight control and Mod III Radio Guidance systems; (7) electrical system to supply and distribute power to user systems; (8) telemetry system containing a telementry package, a manually-activated 28 V dc battery, associated transducers, wiring harness, and two antennas; and (9) flight termination system designed to function on receipt of command signals from ground stations. A.C.R.

**N69-37285*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**AGENA VEHICLE SYSTEM PERFORMANCE**
*In its* Flight Performance of Atlas-Agena Launch Vehicles in support of Lunar Orbiter Missions 3, 4, and 5 Aug. 1969 p 71–94 (See N69-37281 22-31)
Avail: CFSTI CSCL 22B

Specific Agena systems are described, and performance data are given for the flights of Lunar Orbiters 3, 4, and 5. Included are: (1) vehicle structure system, consisting of forward, tank, and aft sections and booster adapter assembly; (2) shroud adapter system to provide environmental protection for the spacecraft prior to and during launch and to allow spacecraft separation; (3) propulsion system with propellant tank pressurization, propellant management, and engine systems; (4) electrical system to supply power, frequency, and voltage requirements for guidance, telemetry, flight termination, propulsion, and pyrotechnic systems; (5) guidance and flight control system to perform necessary functions after Atlas-Agena separation; and (6) communication and control system, consisting of telemetry, tracking, and flight termination subsystems and associated power supplies. A.C.R.

**N69-37286*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**LAUNCH OPERATIONS**
George M. Michalson, Joseph A. Ziemianski, and Alvin C. Hahn *In* its Flight Performance of Atlas-Agena Launch Vehicles in Support of Lunar Orbiter Missions 3, 4, and 5 Aug. 1969 p 95–99 (See N69-37281 22-31)
Avail: CFSTI CSCL 22D

Major activities at the Eastern Test Range for Lunar Orbiter 3, 4, and 5 missions are tabulated, and results given of prelaunch tests. Also reported are significant schedule delays and problems encountered during the prelaunch period. Countdown and launch data are given for the missions; in each case, successful liftoff was achieved, and the performance of the launch vehicle ground equipment was satisfactory. A.C.R.

**N69-37437*#** National Aeronautics and Space Administration, Washington, D.C.
**ESRO-1B: PRESS KIT**
28 Sep. 1969 15 p
(NASA-News-Release-69-138) Avail: NASA Scientific and Technical Information Division CSCL 22B

Preflight information and background data are provided on the scheduled launch of the ESRO-1B by a four-stage Scout rocket from the Western Test Range. Fourth in a cooperative program between the European Space Research Organization (ESRO) and NASA, the 176-lb satellite is to carry eight experiments for studying the polar ionosphere, the Northern Lights, and related phenomena. Scientific measurements are to be concentrated over Northern Europe to enable correlation between ground-based polar ionosphere observations and measurements made simultaneously with sounding rockets launched at Kiruna, Sweden. The flight sequence is outlined, and a fact sheet is included. M.G.J.

**N69-37573*#** TRW Systems Group, Redondo Beach, Calif.
**MISSION ORIENTED STUDY OF ADVANCED NUCLEAR SYSTEM PARAMETERS, PHASE 6. VOLUME 2: TECHNICAL REPORT Final Report**
A. R. Chovit and G. M. Callies Jun. 1968 118 p refs
(Contract NAS8-5371)
(NASA-CR-102248; TRW-01977-6026-R0-00) Avail: CFSTI CSCL 22B

The details of the mission, trajectory, and vehicle analyses are given. The analyses specifically covered spacecraft weights, performance parameters, and assumptions. The analytical approaches are discussed and the results of investigations of problems in connection with the use of nuclear rocket propulsion for manned interplanetary missions are presented. Initially, the use of a 200,000-lb-thrust nuclear engine was considered; this was followed by analyses of the use of a nuclear engine with a thrust in the range from 75,000 to 100,000 lbs. K.W.

**N69-37584*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
**THE ATTITUDE DETERMINATION SYSTEM FOR THE ORBITING ASTRONOMICAL OBSERVATORY**
Paul B. Davenport Sep. 1969 10 p refs Submitted for publication
(NASA-TM-X-63680; X-542-69-417) Avail: CFSTI CSCL 22B

Various applications of attitude estimation as applied to the operation of the Orbiting Astronomical Observatory are enumerated and explained in some detail. The techniques used, the results of these techniques, and the problems encountered during the first nine months of the mission are delineated. The operation

of the Orbiting Astronomical Observatory including the spacecraft and the supporting ground system is briefly described. Author

N69-37615*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**DELTA-A SCIENTIFIC AND APPLICATION SATELLITE LAUNCH VEHICLE**
Charles R. Gunn Sep. 1969 34 p Submitted for publication
(NASA-TM-X-63677; X-470-69-406) Avail: CFSTI CSCL 22D

The Delta launch vehicle, Model 904 is described for potential users. This new model of Delta is composed of the Long Tank Thor first stage, thrust augmented by 9 Castor solid propellant motors; the Delta second stage, converted to higher energy storable propellants, uprated by adoption of the Titan Transtage ablative engine and modernized with a strap-down inertial system that replaces independent autopilots /radio guidance systems in the first and second stages; and the elongated TE-364-4 solid propellant third stage motor that evolved from the Surveyor spacecraft retromotor. Performance, flight environment, organizational interfaces, spacecraft integration requirements, launch operations and costs are provided. This new model of Delta is to be available in mid-1971, cost about $5.0 million dollars and be capable of injecting 4,000 pounds into low earth orbit, 1300 pounds into synchronous transfer orbit, or escaping 900 pounds of payload. Author

N69-37692*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**IN-ORBIT STARTRACKER MISALIGNMENT ESTIMATION ON THE OAO**
R. deJardins Sep. 1969 13 p refs
(NASA-TM-X-63681; X-542-69-418) Avail: CFSTI CSCL 22B

The present Orbiting Astronomical Observatory (OAO-A2) is designed to point its optical axis to any location on the celestial sphere, and then maintain that pointing within one minute of arc while making astronomical observations. Alignment can change due to thermal and launch stresses, the alignment must be performed after the spacecraft is in orbit. Four misalignment parameters are modeled for each startracker: the three rotational misalignments about the coordinate axes, and a null shift in the inner gimbal. Then two procedures for estimating these parameters from in-orbit telemetry are analyzed. The special procedure, which applies when the spacecraft attitude is perfectly known, involves expressing the known true direction cosines of the guide star in terms of the measured gimbal angles and the four unknown misalignment parameters. The general procedure, which applies when the spacecraft attitude is known only to be near nominal, involves considering the trackers by pairs. Some problems encountered in the use of these procedures are briefly described, and the actual misalignment parameters estimated in-orbit on the OAO-A2 are presented. Author

N69-37694*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE INTERROGATION RECORDING AND LOCATION SYSTEM (IRLS) EXPERIMENT**
Charles E. Cote Sep. 1969 26 p
(NASA-TM-X-63667; X-733-69-336) Avail: CFSTI CSCL 22A

The Interrogation, Recording, and Location System (IRLS) is a satellite technological experiment designed to demonstrate the feasibility of employing polar orbiting satellites to determine position-location, and to collect scientific data from remote instrumented platforms which are deployed on a global scale on, or above, the surface of the earth. The experiment commenced with the launching of the Nimbus 3 satellite in April 1969. The following report presents the results of the 2 months of orbital operation during which period, balloon-borne, shipborne, ice island, buoy, and land deployed platforms underwent regularly scheduled interrogations by the IRLS system aboard the Nimbus 3 Satellite. Over 440,000 bits of conveniently formatted engineering and scientific data were collected from points around the world; location accuracies were in accordance with design expectations. Author

N69-37772# Entwicklungsring Nord, Bremen (West Germany).
**INVESTIGATIONS ON AEROSPACE TRANSPORTER AND RECOVERY OF THE UPPER STAGE [UNTERSUCHUNGEN ZUM RAUMTRANSPORTER UND ZUR RUECKFUEHRUNG DER OBERSTUFE]**
J. Hasseloff Jun. 1969 83 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Wiss. Forsch.
(BMWF-FB-W-69-23) Avail: CFSTI

System studies on the horizontally launched aerospace transporter result in the concept of a three-stage reusable vehicle system with thrust reduction. The determination of the structural coefficient of the upper stage ('lifting body') includes experimental design taking into account thermal stress. Investigations on the recovery of an aerodynamic reentry body from orbit lead to equations of motion with six degrees of freedom. The aerodynamic coefficients in the hypersonic range are computed for simple configurations, and an M2 F1-type lifting body. A singularity method is indicated for subsonic flow around lifting bodies. Model experiments are proposed for future investigation. Author (ESRO)

N69-37786# Defence Documentation Center, Alexandria, Va.
**SPACECRAFT FIRES, VOLUME 1: A DOC BIBLIOGRAPHY, JANUARY 1963 - DECEMBER 1968**
Jul. 1969 128 p refs
(AD-689800; DDC-TAS-69-15-Vol-1) Avail: CFSTI CSCL 22/2

The bibliography was prepared to fulfill requests for bibliographic searches on Spacecraft Fires. The impetus for these requests have increased following the tragic loss of three Mission Apollo astronauts while on the launch pad during January 1967. References deal with a study on the minimization of fire and explosion hazards in advance flight vehicles. The references primarily deal with these fire hazards in spacecraft, but other advanced flight vehicles are considered. Atmosphere control in pressurized space capsules also receives special consideration as far as the ignitibility of materials in a 100% oxygen environment. Author (TAB)

N69-37840*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**FLIGHT PERFORMANCE OF THE ATLAS-AGENA LAUNCH VEHICLE IN SUPPORT OF THE APPLICATIONS TECHNOLOGY SATELLITE ATS-3**
Sep. 1969 114 p
(NASA-TM-X-1879) Avail: CFSTI CSCL 22B

Three Applications Technology Satellites were launched by Atlas-Agena vehicles for experimentation in communications, cloud cover photography, and spacecraft environment. The flight performance of the Atlas-Agena vehicle (for ATS-3) from lift-off through the Agena reorientation maneuver is discussed. This flight in November 1967 concluded the Applications Technology Satellite missions launched by the Atlas-Agena vehicle. Author

N69-37884*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**DEVELOPMENT OF SPACE STATION WINDOW ASSEMBLIES**
C. N. Irvine 18 Jul. 1969 23 p ref
(NASA-TM-X-53853) Avail: CFSTI CSCL 22B

The purpose of this effort is to provide a capability to convert the spent S-4B stage, in its space environment, to a habitable working and living area. This publication presents the results of an effort to develop the preliminary technology for installing windows into space structures in earth orbit and includes the proposed "Window Cutting Experiment," which has been classified as a flight technology item. Design definition, fabrication, and testing of the first prototype window assembly using the explosive cutting techniques are described. Author

**N69-37944** World Meteorological Organization, Geneva (Switzerland).
**THE ROLE OF METEOROLOGICAL SATELLITES IN THE WORLD WEATHER WATCH**
1967 72 p refs *Its* World Weather Watch Planning Rept. No. 18
Copyright. Avail: WMO, Geneva

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**N69-37945** World Meteorological Organization, Geneva (Switzerland).
**THE ROLE OF METEOROLOGICAL SATELLITES IN THE WORLD WEATHER WATCH**
*In its* The Role of Meteorol. Satellites in the World Weather Watch 1967 p 1–7 (See N69-37944 22-31)
Copyright. Avail: World Meteorol. Organ., Geneva

The planning report examines the use of meteorological satellites in the global observing system, the application of interrogating satellites for balloon monitoring, the use of balloon-borne cameras for cloud photography, and the determination of balloon lifetime. ESRO

**N69-37946** World Meteorological Organization, Geneva (Switzerland).
**ANNEX 1: PRESENT METEOROLOGICAL SATELLITE SYSTEMS OF THE UNITED STATES. THE TIROS OPERATIONAL SATELLITE (TOS) SYSTEM**
*In its* The Role of Meteorol. Satellites in the World Weather Watch 1967 p 8–14 (See N69-37944 22-31)
Copyright. Avail: World Meteorol. Organ., Geneva

The meteorological satellite system of the United States (TOS satellites) is described, particularly its capabilities as regards cloud distribution, radiation, ozone, temperature profiles, snow and ice cover, humidity profiles, wind and sea conditions, precipitation, pressure, atmospheric turbulence, and thunderstorms. Future requirements for satellite observation are outlined and several satellite projects are described. ESRO

**N69-37947** World Meteorological Organization, Geneva (Switzerland).
**ANNEX 2: THE USE OF SATELLITES FOR METEOROLOGICAL SERVICES IN THE USSR**
*In its* The Role of Meteorol. Satellites in the World Weather Watch 1967 p 15–21 (See N69-37944 22-31)
Copyright. Avail: World Meteorol. Organ., Geneva

Cosmos satellites have supplied information by television cloud photography on the sunlit side and infrared cloud television on the dark side of the earth, actinometric measurements of outgoing radiation in specific wavelength bands. The data received are stored on magnetic tape of photographic film and then processed into nephanalysis charts. An experiment in cloud photography from the MOLNIYA-1 high-orbit satellite revealed the distribution of large-scale cloud systems, and further prospects and development requirements for satellite meteorology are discussed. ESRO

**N69-37948** Paris Univ. (France).
**ANNEX 3: THE EOLE PROGRAMME**
P. Morel *In* World Meteorol. Organ. The Role of Meteorol. Satellites in the World Weather Watch 1967 p 23–28 refs (See N69-37944 22-31)
Copyright. Avail: World Meteorol. Organ., Geneva

A meteorological observation system, the French EOLE project, is described, consisting of 500 instrumented constant-level balloons and interrogation satellites. The parameters to be measured are wind velocity, atmospheric pressure and temperature and relative humidity. The balloon acquisition system of the satellites, telemetry performance, the command system, and the balloon envelope and gondola design are discussed. ESRO

**N69-37949** France. Direction de la Météorologie Nationale, Paris.
**ANNEX 4: THE COLOMBE PROJECT**
*In* World Meteorol. Organ. The Role of Meteorol. Satellites in the World Weather Watch 1967 p 29–31 (See N69-37944 22-31)
Copyright. Avail: World Meteorol. Organ., Geneva

A meteorological observation system, the French COLOMBE project, is described, in which constant-level balloons are used for cloud photography by photographic film or television cameras. The balloons are radar tracked from the ground and from aircraft by a homing device; the aircraft locates the exact touchdown point after parachuting the gondola. The system provides data both for physicists and meteorologists. ESRO

**N69-37950** National Center for Atmospheric Research, Boulder, Colo.
**ANNEX 5: GHOST TEST FLIGHTS IN THE SOUTHERN HEMISPHERE, 1966–1967**
S. Ruttenberg *In* World Meteorol. Organ. The Role of Meteorol. Satellites in the World Weather Watch 1967 p 32–37 (See N69-37944 22-31)
Copyright. Avail: World Meteorol. Organ., Geneva

The results of test flights of meteorological balloons in the Southern Hemisphere are reported. Balloons were started from New Zealand and tracked actively by means of solar cell powered transmitters. The influence of leakage, icing, and water accumulation on the lifetime of the balloons flown at different pressure levels is discussed. Solar azimuth is measured on board the balloons with a photoresistor. Flight parameters such as supertemperature, and package temperature were transmitted to the ground. ESRO

**N69-38201*#** North American Rockwell Corp., Downy, Calif. Space Div.
**ONE-MAN LUNAR FLYING VEHICLE Summary Briefing**
Jul. 1969 85 p
(Contract NAS9-9045)
(NASA-CR-101924; AS69-1) Avail: CFSTI CSCL 22B

A summary of the program to develop the preliminary design of a lunar flying vehicle for transportation of astronauts, scientific equipment and samples between the lunar module and sites of scientific interest is presented. Included in the briefing are: mission analysis, parametric design study, preliminary design study, training plan, resources plan, and conclusions and recommendations. Author

**N69-38202*#** North American Rockwell Corp., Downy, Calif. Space Div.
**STUDY OF ONE-MAN LUNAR FLYING VEHICLE. VOLUME 1: SUMMARY Final Report**
31 Aug. 1969 22 p
(Contract NAS9-9045)
(NASA-CR-101917; SD-69-419-1) Avail: CFSTI CSCL 22B

The primary objectives of this study were to optimize the design and to develop system specifications of the lunar flying vehicle. The scope encompassed parametric investigations, concept generation, and evaluation effort for the definition of a recommended

concept: production of a preliminary design and development of systems specifications of the recommended concept; and definition of resources and crew training plans. In addition to generation of the LFV design, the scope of the study included lunar module integration, flight suit interface studies, and definition of ground support equipment for earth and lunar operations. As a result of parametric studies conducted during the first phase of this effort, a concept was selected which has the following characteristics: (1) stability-augmented control, (2) four gimbaled engines which are clustered beneath the vehicle, (3) a seated pilot position, and (4) an integral X-frame landing gear with 6 hydraulic attenuators. This vehicle is capable of carrying a 370-lb payload in addition to the pilot. The dry weight of the vehicle is 304 lb. When loaded with 300 pounds of LM descent state propellants, the vehicle can operate with a 4.6 nautical mile radius with no payload. Author

**N69-38203*#** North American Rockwell Corp., Downey, Calif. Space Div.

**STUDY OF ONE-MAN LUNAR FLYING VEHICLE. VOLUME 2: MISSION ANALYSIS Final Report**

31 Aug. 1969 160 p refs

(Contract NAS9-9045)

(NASA-CR-101918; SD-69-419-2) Avail: CFSTI CSCL 22B

The mission analysis focused on the investigation of problem areas associated with the successful use of the lunar flying vehicle (LFV) in the lunar environment. The term successful was interpreted as providing at least the minimum mobility desired, being within the capability of the astronauts to assemble and operate, and being safely operational within the unique environment. Because of the uncertainty of the final design, the flight performance analysis was accomplished parametrically. Since one of the major areas of uncertainty and sources of potential hazard involved the effect of the LFV exhaust plume on the lunar soil, analyses of theoretical and experimental soil erosion data were conducted. The results were reflected in the LFV operations and design. Author

**N69-38204*#** North American Rockwell Corp., Downey, Calif. Space Div.

**STUDY OF ONE-MAN LUNAR FLYING VEHICLE. VOLUME 3: SUBSYSTEM STUDIES Final Report**

31 Aug. 1969 518 p refs

(Contract NAS9-9045)

(NASA-CR-101919; SD-69-419-3) Avail: CFSTI CSCL 22B

The optimum propulsion subsystem design criteria were investigated by conducting a parametric study of the major design alternatives throughout a wide range of significant operating variables. The key item was rocket engine information supplied by competitive manufacturers. In addition to pressurization and servicing alternatives, the components were required to provide an initial basepoint design for parametric study, and collect data for the tradeoff study. Results are summarized in tables and graphs. Author

**N69-38205*#** North American Rockwell Corp., Downey, Calif. Space Div.

**STUDY OF ONE-MAN LUNAR FLYING VEHICLE. VOLUME 4: CONFIGURATION DESIGN Final Report**

31 Aug. 1969 346 p refs

(Contract NAS9-9045)

(NASA-CR-101920; SD-69-419-4) Avail: CFSTI CSCL 22B

The general subjects of configuration design and design integration of the lunar flying vehicle are presented. The results of the landing gear subsystem, structure, and payload integration design are included. Design integration aspects covered include human factors, reliability, mass properties, and lunar support equipment. All of these subjects are treated in detail as part of the design of the baseline vehicle. An alternate design for the baseline mission using available engines in a pulsed mode is also described. Author

**N69-38206*#** North American Rockwell Corp., Downey, Calif. Space Div.

**STUDY OF ONE-MAN LUNAR FLYING VEHICLE. VOLUME 4: CONFIGURATION DESIGN APPENDIXES Final Report**

31 Aug. 1969 268 p

(Contract NAS9-9045)

(NASA-CR-101921; SD-69-419-4) Avail: CFSTI CSCL 22B

The configuration of a one-man crew spacecraft with variable payload which is stability augmented using eight actuators for attitude control is described. The body structure is basically sheet-stringer with trusses to support two 20-inch spheroidal propellant tanks. The vehicle is designed to land on four integrally framed legs with horizontal and vertical attenuation to the body combined in eight identical shock absorbers. Main propulsion is provided by four gimbaled engines. Author

**N69-38207*#** North American Rockwell Corp., Downey, Calif. Space Div.

**STUDY OF ONE-MAN LUNAR FLYING VEHICLE. VOLUME 5: PRELIMINARY DESIGN AND SPECIFICATIONS Final Report**

31 Aug. 1969 118 p

(Contract NAS9-9045)

(NASA-CR-101922; SD-69-419-5) Avail: CFSTI CSCL 22B

The specifications which establish the performance, design development, and test requirements for the lunar exploration activity are presented. The system specification, in conjunction with the end item specifications of the system elements, form the documentation establishing the system technical requirements, test requirements, and configuration description. Author

**N69-38208*#** North American Rockwell Corp., Downey, Calif. Space Div.

**STUDY OF ONE-MAN LUNAR FLYING VEHICLE. VOLUME 6: RESOURCES AND TRAINING PLANS Final Report**

31 Aug. 1969 98 p

(Contract NAS9-9045)

(NASA-CR-101923; SD-69-419-6) Avail: CFSTI CSCL 22B

The plans for two prime areas are presented: (1) the plans associated with detailed design, development, and fabrication of the lunar flying vehicle system; and the plans associated with training of the astronauts to utilize the system in lunar operations. The results of an analysis conducted to define resources required for the Phases C and D one-man lunar flying vehicle activities are discussed. Included are a description of the approach used to obtain the resources data, a program summary, development plans for certain key functional areas, and a summary of cost data. The astronaut training plan defines general flight crew behavioral objectives, and the training support for the operational aspects of the one-man program. Author

**N69-38960*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**DYNAMICAL PERFORMANCE TO DATE OF RAE-A (EXPLORER 38)**

David L. Blanchard May 1969 64 p refs Submitted for publication

(NASA-TM-X-63885; X-723-69-214) Avail: CFSTI CSCL 22B

A unique tactical scheme was devised, studied and then successfully used for the deployment and gravity-gradient capture the RAE-A. The attitude stability was very good during and following deployment. It is the purpose of this report to describe in detail this sequence of deployment maneuvers and to present a comparison of the computer simulations to the observed attitude data during these deployments as well as a summary of data since deployment. The underlying concept used in all the deployments is called dead beat and is described. Also reported is a study of the use of this technique to achieve gravity-gradient capture under a wide range of initial conditions. Author

# 32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

**N69-37242#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**ON THE PROBLEM OF THE INTERACTION BETWEEN RECTILINEAR CRACKS OF A GIVEN ORIENTATION**
L. T. Berezhnitskii et al 24 Feb. 1969 15 p refs Transl. into ENGLISH from Prikl. Mekhan. (USSR), v. 4, no. 3, 1968 p 112–117
(AD-688072; FTD-HT-23-1060-68) Avail: CFSTI CSCL 20/11

The character of the interaction of rectilinear cracks of one and the same orientation is investigated. An analysis is made of the limit loads for cracks located along a given straight line, and an orientation evaluation is given of mutual strengthening of two linear parallel cracks. On the basis of an approximate solution of the problem of the limiting equilibrium of a plate, weakened by an infinite series of parallel shifted cracks of equal length, there are established some new qualitative and quantitative peculiarities of mutual influence in systems consisting of rectilinear cracks of a given orientation. Author (TAB)

**N69-37289#** RAND Corp., Santa Monica, Calif.
**TRANSIENT MOTION OF AN ELASTIC HALF-SPACE DUE TO A SEMI-INFINITE SURFACE LINE LOAD**
D. C. Gakenheimer Jun. 1969 9 p refs
(AD-688987; P-4081) Avail: CFSTI CSCL 20/11

A method is described for obtaining an exact transient solution to the problem of an elastic half-space whose surface is excited by a semi-infinite line load. The load acts normal to the surface of the half-space and it has impulsive time dependence. The resulting displacement field is discussed in some detail. Author (TAB)

**N69-37263#** California Univ., Berkeley. Div. of Applied Mechanics.
**A MIXTURE OF VISCOUS ELASTIC MATERIALS WITH DIFFERENT CONSTITUENT TEMPERATURES**
R. E. Craine (East Anglia Univ.), A. E. Green (Oxford Univ.), and P. M. Naghdi May 1969 33 p
(Contract N00014-67-A-0114)
(AD-689236; AM-69-8) Avail: CFSTI CSCL 20/11

Constitutive equations are discussed for a mixture of any number of materials with elastic and viscous properties in which the constituents may have different temperatures. Author (TAB)

**N69-37287#** Royal Aircraft Establishment, Farnborough (England).
**FATIGUE LIFE ESTIMATION UNDER SPECIAL LOADING SPECTRA BY MEANS OF VARIABLE AMPLITUDE FATIGUE STRENGTH DATA OBTAINED WITH STANDARD SPECTRA [DIE LEBENSDAUERABSCHAETZUNG BEI SONDERKOLLEKTIVEN NACH BETRIEBSFESTIGKEITSVERSUCHEN MIT EINHEITSKOLLEKTIVEN]**
H. Ostermann May 1969 20 p refs Transl. into ENGLISH from ICAF Doc. #425, German Report TB-80
(RAE-LIB-Trans-1357; TB-80) Avail: CFSTI

The various fatigue loading spectra which occur in service are summarized and examples are given to illustrate the sensitivity of fatigue strength to spectral shape. The difficulties inherent in the prediction of fatigue strength under certain special loading spectra are discussed, and a new life prediction technique is proposed based on the use of universal fatigue strength data obtained under a number of standard block program loading spectra. An example using notched specimens in AlCuMg2 shows good agreement with experimental results, but further work will be necessary before the applicability of the techniques can be fully assessed. Author

**N69-37376#** National Aerospace Lab., Tokyo (Japan).
**APPLICATIONS OF THE FINITE ELEMENT METHOD TO BOX BEAMS**
Shigeo Sanbongi 1968 11 p refs In JAPANESE; ENGLISH summary
(NAL-TR-165) Avail: CFSTI

The finite element method is applied to wing-type structures subjected to bending and torsional loading. In-plane and axial forces are assumed for cover skin and stringer elements. A stiffness matrix consisting of a tapered spar element with angle-cross-section flanges is derived by extending a previous method. This matrix presents excellent convergence characteristics. Displacement distribution of a swept-back box beam and stress distribution of a box beam with trapezoidal cross section are computed. Good agreement was found between computed values and experimental results. Author

**N69-37439#** Israel Inst. of Tech., Haifa. Dept. of Mechanics.
**ELEMENTS OF LINEAR ELASTOSTATICS OF ISOTROPIC NON-HOMOGENEOUS BODY WITH VARIABLE POISSON'S RATIO**
J. J. Golecki and R. J. Knops Sep. 1969 25 p refs Sponsored in part by Newcastle Univ. (England)
(TDM-69-8) Avail: CFSTI

The report presents a review of nonhomogeneity in elasticity; elements of the theory of static deformation for a linear elastic isotropic nonhomogeneous body whose shear modulus is a constant and whose Poisson's ratio is a variable; and their applications. The above elastic nonhomogeneity was introduced as a description of the behavior of a certain class of bodies and in order to point out the influence of the variability of Poisson's ratio on displacement and stress. In this case, an effective method of solving the boundary problems was derived. As an example, a half-plane with variable Poisson's ratio was considered. Author

**N69-37484#** Pisa Univ. (Italy).
**ON THE PROPAGATION OF SHOCK WAVES OF DISCONTINUITY IN A THERMOELASTIC WIRE [SULLA PROPAGAZIONE DI ONDE STRAORDINARIE DI DISCONTINUITA IN UN FILO TERMOELASTICO]**
Carlo Silli [1967] 142 p refs In ITALIAN; ENGLISH summary
*Its* Ser. 25, No. 1168
Avail: CFSTI

The possibility of the existence of discontinuous shock waves in a thermoelastic wire is investigated in the case where the wire is not necessarily homogeneous and perfect in nonlinear stress–strain relation. It is concluded that in a nonperfect wire the only possible waves are the thermal waves, while in a perfect wire, neither the mechanical shock waves, nor the thermal waves are possible. Author

**N69-37720#** Oak Ridge National Lab., Tenn.
**PROGRAM ADMINISTRATION AND PROCUREMENT**
*In its* Heavy-Sect. Steel Technol. Program Apr. 1969 p 1–12 refs (See N69-37719 22-17)
Avail: CFSTI

The fabrication and heat treatment of the third and fourth HSST plates are described. Sections were rerolled to 4 in. and 8 in. gage. Thermocouples were used to record austenitizing, quenching, and tempering data. The thinner plates met impact and/or drop weight requirements. The plates were inspected by ultrasonic longitudinal and shear wave techniques. Ten foot long arc welds were fabricated and inspected. NSA

**N69-37723#** Oak Ridge National Lab., Tenn.
**PRESSURE VESSEL INVESTIGATIONS**
*In its* Heavy-Sect. Steel Technol. Program Apr. 1969 p 97–109 refs (See N69-37719 22-17)
Avail: CFSTI

Activities devoted to complex-stress-state investigations,

periodic proof testing, and warm prestressing of simulated pressure vessel materials are reported. Information is included on fabrication of molded epoxy models and on evaluation of periodic proof testing and warm prestressing methods used to establish assurance against pressure vessel failure. NSA

N69-37745# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
**STIFFNESS MATRIX FOR CURVED-TAPERED AND STRAIGHT-TAPERED SHELL STIFFENERS**
Richard H. Cocio Mar. 1969 66 p refs
(Contract F04694-67-C-0039)
(AD-689435; ASRL-TR-146-6; SAMSO-TR-69-135) Avail: CFSTI CSCL 13/13

The element stiffness matrix and the consistent nodal force matrix for either a straight-tapered or constant radius-tapered shell stiffener is formulated using an assumed displacement method. The resulting expressions for the elements of the matrices are left in integral forms which can be evaluated using available numerical integration techniques. Author (TAB)

N69-37754# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
**CONCEPT OF LINE ENERGY FOR A CRACK FRONT**
F. F. Lange 29 May 1969 12 p refs
(Contract N00014-68-C-0323)
(AD-688846; TR-1) Avail: CFSTI CSCL 20/11

Based on the known elastic stress distribution associated with a stressed stationary crack, an expression for the line energy per unit length of crack front is determined. At the stress required to propagate the crack, this expression reduced to two factors, viz. the dimension of the crack and the energy absorbed in creating new fracture surface area. This concept may be useful where line tension arguments are used to explain the interaction of a crack front with various obstacles it encounters both prior to and during fracture. Author (TAB)

N69-37816# British Iron and Steel Research Association, London (England). Metallurgy Div.
**A NEW APPROACH TO SUB-CRITICAL FLAW GROWTH**
M. J. May, C. E. Nicholson, and A. H. Priest 1968 22 p refs Presented at the BISRA/ISI Conf. on Low Alloy Steels, Carborough, England
(MG/A/54/68) Avail: CFSTI

The application of linear elastic fracture mechanics to the study of subcritical flaw growth by stress corrosion cracking and fatigue are considered. It is shown that the factor controlling crack propagation is the stress intensity at the tip of the crack. The benefits of the fracture mechanics approach over the more conventional qualitative approaches are discussed. Author

N69-37820# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
**HIGH FREQUENCY, PERIODIC DISTURBANCES IN DISSIPATIVE SYSTEM. PART 1. SMALL AMPLITUDE, FINITE RATE THEORY**
B. R. Seymour and E. Varley Feb. 1969 56 p refs
(Contract DAADO5-69-C-0053; Proj. Themis)
(AD-689479; CAM-110-1) Avail: CFSTI CSCL 20/11

A theory is developed describing finite amplitude, high frequency, periodic disturbances in dissipative systems. Although, for definiteness, the transmitting medium is taken to be a viscoelastic string, the results are applicable to nonlinear transmission lines and nonlinear dielectrics, as well as relaxing and reacting gas mixtures. Part I of the paper describes small amplitude but finite rate processes; part II will describe disturbances of unrestricted amplitude. It is shown that by interpreting high frequency waves as modulated simple waves with slowly changing Riemann invariants, the parameter expansion techniques of geometrical optics can be modified to include finite amplitude waves. The roles of the linear models of viscoelasticity and elasticity as well as that of nonlinear elasticity as approximations to the nonlinear viscoelastic model are elucidated. Author (TAB)

N69-37823# Watervliet Arsenal, N.Y. Benet R and E Labs.
**HIGH FREQUENCY VIBRATIONS IN PLATE STRIPS**
Gary Anderson May 1969 108 p refs
(AD-689480; WVT-6913) Avail: CFSTI CSCL 13/13

The equations of motion for extensional and flexural vibration of elastic isotropic plates are derived systematically with the aid of Yu's generalization of Hamilton's principle. Using the resulting Kane-Mindlin equations for extensional motions, the frequency spectrum of an infinite plate strip is investigated for three types of boundary conditions. Author (TAB)

N69-38008# Catholic Univ. of America, Washington, D.C.
**DYNAMICS OF SUBMARINE STRUCTURES, VOLUME 2, PART 1 final Report, 1 Jun. 1967 – 31 May 1968**
J. H. Baltrukonis Mar. 1969 97 p refs
(Contract N00014-67-A-0377)
(AD-689203) Avail: CFSTI CSCL 20/11

A study has been conducted concerning the difficulties associated with the development of a digital computer program for the calculation of the response of highly-complex, submarine (or submerged) structures to arbitrary dynamic excitation. The complicating aspect of this problem is the solution of the equations of motion. In reality, two problems must be solved simultaneously: (1) structural vibrations, and (2) radiation of mechanical energy into the surrounding fluid. The present study was concerned almost solely with the former problem. Three methods are explored: mode superposition, Fourier transform and time marching. In each case the equations of motion are formulated by means of the finite element method. Each method is discussed in some detail. A computer program is presented for the computation of the natural frequencies of free, longitudinal vibrations of long, thin, prismatical rods. TAB

N69-38106# Lockheed Missiles and Space Co., Palo Alto, Calif.
**ON THE INTEGRATION OF EQUILIBRIUM EQUATIONS OF A CYLINDRICAL SHELL**
I. N. Vekua [1969] 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 186, no. 4, Jun. 1969 p 787–790
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The elastic equilibrium of a thin, circular, cylindrical shell of constant thickness and radius is investigated, and the resultant elliptic system of twelfth-order equations with constant coefficients is analyzed. The approximate solutions derived can be used to solve various boundary value problems. The formulas allow reduction of the solution of boundary value problems for cylindrical shells to two similar boundary value problems of the elastic equilibrium for a model plate. A.C.R.

N69-38318# Hayes International Corp., Birmingham, Ala.
**DESIGN MANUAL FOR GROUND-MOUNTED AIR-SUPPORTED STRUCTURES (SINGLE- AND DOUBLE-WALL Technical Report, May 1966 – May 1969**
A. E. Dietz, R. B. Proffitt, R. S. Chabot, and E. L. Moak Jan. 1969 143 p refs Revised
(Contract DA-19-129-AMC-953(N))
(AD-690234; USA-NLABS-TR-69-59-GP) Avail: CFSTI CSCL 13/13

The objective of this design manual is to provide design information to fabricate functional and reliable air-supported structures at the lowest possible weight. The data and design information presented are based on wind tunnel tests and analytical determinations reported in a previous investigation. Design information is given for spherical and cylindrical (single- and double-wall) air-supported structures. The data in general are

presented in nondimensional coefficient form and, therefore, are applicable to full-scale structures within the range of parameters tested. Design information is presented as charts and tables of tent aerodynamic force and moment coefficients, anchor and guyline coefficients, structural deflections, material stresses, packaged volumes, and weight. Author (TAB)

**N69-38333#** Combustion Engineering, Inc., Windsor, Conn. Nuclear Power Dept.

**VANADIUM PURIFICATION Quarterly Progress Report, 1 Oct. 1968 - 31 Mar. 1969**

J. C. La Vake, S. S. Christopher, and J. R. Stewart Apr. 1969 16 p

(Contract AT(30-1)-3742)

(CEND-3742-352) Avail: CFSTI

Stress-rupture testing was continued on the high purity V-15Cr-5Ti sheet to obtain data on time-to rupture and minimum-creep-rate properties. Five hundred-hour stress-rupture tests have shown contamination; however, modifications to the creep furnace, are expected to eliminate this. Recrystallized sheet has been electron beam and TIG welded. The TIG welds showed low ductility due to precipitate agglomeration. Heat treatments are being performed in an attempt to increase ductility. Electron beam welds, with their faster cooling rates, showed good ductility. Author (NSA)

**N69-38348#** Naval Civil Engineering Lab., Port Hueneme, Calif.

**WINDOWS FOR EXTERNAL OR INTERNAL HYDROSTATIC PRESSURE VESSELS. PART 3: CRITICAL PRESSURE OF ACRYLIC SPHERICAL SHELL WINDOWS UNDER SHORT-TERM PRESSURE APPLICATIONS Final Report, Jul. 1966 - Aug. 1968**

J. D. Stachiw and F. W. Brier Jun. 1969 166 p refs

(NCEL-TR-631-Pt-3) Avail: CFSTI CSCL 13/13

Model and full-scale acrylic windows in the form of spherical shell lenses with parallel convex and concave surfaces have been imploded by loading their convex surface hydrostatically at a 650-psi/min rate while their concave surface was exposed to atmospheric pressure. The thickness of the model windows varied from 0.250 to 1.200 inches and of the full-scale windows from 0.564 to 4.000 inches, while the included spherical sector angle of the lens and the bevel angle of its edge varied from 30 to 180 degrees in 30-degree increments. The low-pressure face diameters of the model windows varied from 1.423 to 5.500 inches, while those of the full-scale windows varied from 6.200 to 35.868 inches. In addition to critical pressures, displacements of the lens under hydrostatic pressure were recorded and plotted as functions of pressure. For part one, see N67-24842; for part 2, see N67-32867 Author (TAB)

**N69-38517#** Gulf General Atomic San Diego, Calif.

**AUTOCLAVE CORROSION TESTS OF WELDED AND BENT STEAM GENERATOR TUBES FOR PSC**

D. I. Roberts, J. F. Hildebrand, and R. Stetson 30 Apr. 1969 70 p refs

(Contract AT(04-3)-633)

(GA-9299) Avail: CFSTI

Results of 1000-hr autoclave corrosion tests that were performed in order to identify the effects of steam generator fabrication features on the stress corrosion behavior of Sanicro 31 Ni-Fe-Cr alloy are described. The tests were designed to show possible adverse effects of residual stresses from short radius bends and bimetallic welds. Both stress-relieved and non-stress-relieved specimens were tested. The tests were performed using environmental conditions which, from previous experiments, relating to the Peach Bottom steam generators, were known to be very aggressive and capable of causing stress corrosion and pitting in austenitic steels. These environments were based on exposing the specimens to 1400-psi wet steam at 600°F with chloride-bearing water intermittently sprayed onto, and flashing off, the test specimen surfaces. In one set of tests the oxygen level in the steam was kept low (not detectable except at start of test), and the chloride was adjusted to a nominal value of 2 ppM in the effluent. Author (NSA)

# 33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

**N69-37389#** European Space Research and Technology Center, Noordwijk (Netherlands).

**DETERMINATION OF THE THERMAL BEHAVIOUR OF A SATELLITE [DETERMINATION DU COMPORTEMENT THERMIQUED'UN SATELLITE]**

M. Toussaint Paris ESRO Feb. 1969 48 p refs In FRENCH; ENGLISH summary Presented at the ESRO Summer School, Noordwijk, Neth., 1968

(ESRO-TM-107) Avail: CFSTI

The subject of the present work is the prediction of the orbital temperatures of a spacecraft. After a brief review of the environmental conditions in near-earth orbit and the most common techniques of temperature calculation, the mathematical model of the satellite, i.e. all the parameters which govern its thermal behaviour, is defined, the methods which enable these parameters to be determined individually are described, and the accuracy of these methods is discussed. It is then shown how the model can be defined more precisely by subjecting a complete mock-up of the satellite to what is called a 'verification' test in a space simulation chamber. A method of analysing the results of a test of this kind is proposed, and the choice of optimum experimental conditions is discussed in relation to measurement errors and orbital conditions. Author (ESRO)

**N69-37415*#** Dynatech Corp., Cambridge, Mass.

**THERMOPHYSICAL PROPERTIES OF HOT PRESSED BERYLLIUM**

R. P. Tye 1 Jul. 1968 33 p refs Prepared for GE, Philadelphia, Pa

(Contract NAS1-6039; Dynatech Proj. GES-4)

(NASA-CR-98217; Rept-796) Avail: CFSTI CSCL 20M

The thermal conductivity of hot-pressed beryllium was measured on 12 samples of slightly different purities over the range from 300° to 1200°K. The measurements were made using the method of longitudinal heat flow in a rod surrounded by a matched temperature gradient guard tube. Small differences in this property and in the electrical resistivity were found for individual samples, but for samples of the same batches the values were in good agreement. Specific heat measurements were carried out to the order of 1100°K by a combination of adiabatic and drop calorimetry in 13 samples. No really significant differences were found to exist for the different batches. Author

**N69-37466#** European Space Research and Technology Center, Noordwijk (Netherlands).

**THE DETERMINATION OF SURFACE TEMPERATURES**

M. Janes Paris ESRO Feb. 1969 33 p refs Presented at the 6th ESRO Summer School, Noordwijk, Neth., 1968

(ESRO-TN-78) Avail: CFSTI

The two methods normally used in the technology of today for the determination of surface temperatures, namely small temperature sensors placed on the surface of the object under investigation and infrared thermometry, are described in this paper. The fundamental laws which form the basis for both methods are either deduced or briefly discussed. Technological problems resulting from the use of small sensors are outlined. An example of infrared thermometry, the AGA thermovision camera, is described and its

operation explained. Experiments carried out to illustrate the two methods are described in appendices. Author (ESRO)

N69-37467# European Space Research and Technology Center, Noordwijk (Netherlands).
**MINIMISATION OF ERROR INDUCED BY SPIN REVERSALS IN FLUX INCIDENT ON A SATELLITE IN A TEST CHAMBER**
H. A. Schutz Paris ESRO Jan. 1969 27 p refs
(ESRO-TN-38-ESTEC) Avail: CFSTI

In the ESTEC thermal vacuum test chambers HBF 2 and HBF 3 the spacecraft models are mounted on to a motion gear which limits rotation to 3 full revolutions. This restriction is imposed by the cable connections used for signal transmission. The effects on the integrated radiative heat input of reversals in the spin motion are investigated for the case of a cylinder spinning about its axis of symmetry. The angle of rotation which gives the smallest variation of the total incident flux is determined. The influence of divergent light beams compared with parallel light is estimated. Author (ESRO)

N69-37502# Institut d'Aéronomie Spatiale de Belgique, Brussels.
**AERONOMICAL APPLICATIONS OF THE GAS TRANSPORT COEFFICIENTS [LES COEFFICIENTS DE TRANSPORT DES GAZ EN VUE D'APPLICATIONS AERONOMIQUES]**
L. A. Mata 1969 56 p refs In FRENCH; ENGLISH summary
Submitted for publication /ts Aeronomica Acta No. A-59-1969
Avail: CFSTI

Formulas have been established for the thermal conductivity and diffusion coefficients for use in aeronomy, starting from the classical Enskog-Chapman theory concerning the properties of transport of gases, from the theoretical aspect of transport of internal energy and from the experimental values. Thermal conductivity coefficients are given for gases and gas mixtures in the high atmosphere. Diffusion coefficients are also given for binary mixtures. Such formulas seem to be a satisfactory approximation for aeronomical problems. Author (ESRO)

N69-37526# European Space Research Organization, Paris (France).
**ENVIRONMENTS AND THEIR ROLE IN SPACECRAFT TECHNOLOGY VOL. 2: THERMAL ASPECTS**
Feb. 1969 218 p refs Partly in ENGLISH and partly in FRENCH
Proc. of the 8th ESRO Summer School, Noordwijk, Neth., 1968
(ESRO-SP-41) Avail: CFSTI

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1. DETERMINATION OF THE THERMAL BEHAVIOUR OF A SATELLITE M. Toussaint (Europ. Space Res. and Technol. Center, Noordwijk) p 1–44 refs (See N69-37527 22-33)

2. GENERATING THE THERMAL ENVIRONMENT OF A SPACECRAFT IN THE LABORATORY E. H. Classen (Europ. Space Res. and Technol. Center, Noordwijk), J. H. Maklink (Europ. Space Res. and Technol. Center, Noordwijk), and J. B. Walker (Europ. Space Res. and Technol. Center, Noordwijk) p 45–112 refs (See N69-37528 22-11)

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6. THE DETERMINATION OF SURFACE TEMPERATURE M. Janes (Europ. Space Res. and Technol. Center, Noordwijk) p 187–218 refs (See N69-37532 22-33)

N69-37527# European Space Research and Technology Center, Noordwijk (Netherlands).
**DETERMINATION OF THERMAL BEHAVIOUR OF A SATELLITE [DETERMINATION DU COMPORTEMENT THERMIQUE D'UN SATELLITE]**
M. Toussaint *In* ESRO Environments and their Role in Spacecraft Technol., Vol. 2: Feb. 1969 44 p refs In FRENCH (See N69-37526 22-33)
Avail: CFSTI

The subject of this work is the prediction of the temperature of a satellite in orbit. After briefly recalling the environment met on an earth orbit and the most used techniques for temperature computation, a mathematical model is presented i.e. the set of parameters which will govern the satellite's thermal behaviour, a description of the method by which these parameters may be individually ascertained and a discussion of their accuracy. It is then shown how a better knowledge of the model can be gained by submitting the integrated model of the satellite to a test in a simulation chamber. A method for analyzing the results and the choice of the most suitable experiment conditions is discussed as a function of measurement errors and orbital conditions. Author (ESRO)

N69-37528# European Space Research and Technology Center, Noordwijk (Netherlands).
**IMPERFECTIONS IN THE SIMULATION OF THE THERMAL ENVIRONMENT OF A SPACECRAFT**
J. Doenecke *In* ESRO Environment and their Role in Spacecraft Technol., Vol. 2: Feb. 1969 15 p refs (See N69-37526 22-33)
Avail: CFSTI

The differences between the thermal environments which a spacecraft encounters in a test chamber and in real space are caused by several phenomena. These are radiation reflected and emitted by the chamber walls and windows, radiation and conduction from or in the spacecraft supporting device, and imperfections of the solar and planetary radiation simulators. This paper shows how the influences of these imperfections in simulation can be considered in the thermal analysis and gives the basis of reduction of these imperfections. Possible future development of thermal balance tests is briefly treated. Author (ESRO)

N69-37530# European Space Research and Technology Center, Noordwijk (Netherlands).
**THERMAL CONTROL SURFACES**
M. J. Downey and G. Schamié *In* ESRO Environments and their Role in Spacecraft Technol., Vol. 2: Feb. 1969 38 p refs (See N69-37526 22-23)
Avail: CFSTI

This paper emphasizes the significance of the solar absorptance and hemispherical emittance values of thermal control surfaces in heat balance calculations. The various types of thermal control surface that can be used are considered and a description is given of the factors that cause changes in surface parameters in space. The paper includes some comments on active versus passive control and on the nomenclature used in thermophysics. Author (ESRO)

N69-37532# European Space Research and Technology Center, Noordwijk (Netherlands).
**THE DETERMINATION OF SURFACE TEMPERATURE**
M. Janes *In* ESRO Environments and their Role in Spacecraft Technol., Vol. 2: Feb. 1969 30 p refs (See N69-37526 22-33)
Avail: CFSTI

The two methods normally used in the technology of today for the determination of surface temperature, namely small temperature sensors placed on the surface of the object under investigation and infrared thermometry, are described in this paper. The fundamental laws which form the basis for both methods are

either deduced or briefly discussed. Technological problems resulting from the use of small sensors are outlined. An example of infrared thermometry, the AGA thermovision camera, is described and its operation explained. Experiments carried out to illustrate the two methods are described in appendices. Author (ESRO)

**N69-37649#** European Space Research and Technology Center, Noordwijk (Netherlands).
**THERMAL CONTROL SURFACES**
M. J. Downey and G. Schamlé Paris ESRO Feb. 1969 30 p refs Presented at the 6th ESRO Summer School, Noordwijk, Neth., 1968
(ESRO-TN-73) Avail: CFSTI

This paper emphasizes the significance of the solar absorptance and hemispherical emittance values of thermal control surfaces in heat balance calculations. The various types of thermal control surfaces that can be used are considered and a description is given of the factors that cause changes in surface parameters in space. The paper includes some comments on active versus passive control and on the nomenclature used in thermophysics. Author (ESRO)

**N69-37571*#** Stanford Research Inst., Menlo Park, Calif.
**INVESTIGATION OF COMBUSTION INSTABILITY IN HYBRID ROCKETS Final Report**
C. E. Wooldridge, G. A. Marxman, and R. J. Kier [1968] 131 p refs
(Contract NAS1-7310; SRI Proj. 6638)
(NASA-CR-66812) Avail: CFSTI CSCL 21B

Experiments were principally concerned with the delineation of steady-state hybrid propellant regression rate/pressure coupling in the pressure-sensitive regime, because acoustic instability is expected to depend on the same coupling mechanism. The data established at the onset of the observed dependence of regression rate on pressure at low pressure is attributable to the behavior of the chemical kinetic processes in the gas-phase flame zone. This result provided the basis for theoretical studies. A model based on classical turbulent flame theory was proposed, and a mathematical analysis was developed that provided good agreement with the observed steady-state regression rate/pressure dependence at the fixed oxidizer mass flux. During a few of the experiments, a spontaneous instability corresponding to the longitudinal mode of the chamber was observed. Author

**N69-37577*#** Space Ordnance Systems, Inc., Saugus, Calif.
**HOT WIRE INITIATORS LOADED WITH NON-CONDUCTIVE PROPELLANT (SOS-200) Evaluation Test Report**
G. Drinkard and H. Martin [1969] 136 p refs
(Contract NAS1-7471)
(NASA-CR-66764) Avail: CFSTI CSCL 20M

Each of 80 test specimens was subjected to the hermetic seal, insulation resistance, bridgewire resistance, environmental seal, dielectric strength tests, interbridgewire resistance and capacitance tests, and all performed within the specification requirements. The test specimens werethen subjected to an electrostatic pulse of 25,000 volts DC, after which the units were again tested for interbridge resistance and capacitance. No significant shift in interbridgewire resistance of capacitance was noted as a result of the electrostatic discharge. Author

**N69-37770#** Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
**AN EXPERIMENTAL METHOD FOR DETERMINING HEAT TRANSFER DISTRIBUTIONS ON BLUNT BODIES AT HYPERSONIC MACH NUMBERS Final Report, Dec. 1966–Jan. 1968**
Frederick Karl Hube Jun. 1969 71 p refs Prepared in cooperation with ARO, Inc.
(Contract F40600-69-C-0001)
(AD-689176; AEDC-TR-69-20) Avail: CFSTI CSCL 20/4

Experimental convective heat transfer distributions on a hemisphere-cylinder configuration were obtained using slug calorimeters and Gardon gages. Wind tunnel tests were conducted at a nominal Mach number of 10 over a free-stream Reynolds number range from 310,000 to 1,040,000 based on the model diameter (5.80 inches). The data were compared with theoretical heat transfer values and data obtained with thin-skin colorimetric wind tunnel models. The slug calorimeter data were highly time dependent due to conduction heat losses; consequently, the data did not compare favorably with theoretical predictions. Gardon gage indicated heat transfer was in very good agreement with both theoretical values and data from other sources. Author (TAB)

**N69-37807#** National Bureau of Standards, Washington, D.C. Building Research Div.
**SMOKE AND GASES PRODUCED BY BURNING AIRCRAFT INTERIOR MATERIALS**
D. Gross, J. J. Loftus, T. G. Lee, and V. E. Gray Feb. 1969 31 p refs *Its* Building Sci. Ser. No. 18
(Contract FA-66-NF-AP-7)
Avail: SOD $0.35

Measurements are reported of the smoke produced during both flaming and smoldering exposures on 141 aircraft interior materials. Smoke is reported in terms of specific optical density, a dimensionless attenuation coefficient which defines the photometric obscuration produced by a quantity of smoke accumulated from a specimen of given thickness and unit surface area within a chamber of unit volume. A very wide range in the maximum specific optical density was observed. For the majority of materials, more smoke was produced during the flaming exposure test. However, certain materials produced significantly more smoke in the absence of open flaming. During the smoke chamber tests, indications of the maximum concentrations of CO, HCl, HCN, and other selected potentially toxic combustion products were obtained using commercial colorimetric detector tubes. A study was made of the operation, accuracy, and limitations of the detector tubes used. Measurements of the concentrations of HCl were also made using specific ion electrode techniques. Qualitative identification of the major components of the original test materials was accomplished primarily by infrared absorption spectrophotometry. Author

**N69-37855#** Fire Research Station, Borehamwood (England).
**EXPLOSIBILITY TESTS FOR INDUSTRIAL DUSTS**
Monica M. Raftery 1968 18 p refs *Its* Tech. Paper No. 21
Copyright. Avail: CFSTI; HMSO 6s

This paper describes apparatus and procedures for testing suspensions of industrial dusts for explosibility. The tests are used for classifying dusts according to their explosibility and for measurement of the various parameters used to assess their explosibility hazard. Author

**N69-37900#** Brookhaven National Lab., Upton, N.Y.
**THERMAL CONDUCTIVITY AND VISCOSITY OF HELIUM AT LOW TEMPERATURES**
George C. Lindauer Sep. 1968 12 p refs
(BNL-50138) Avail: CFSTI

The Enskog method was used to calculate the thermal conductivity and viscosity of helium at temperatures from 4° to 20°K and at pressures from 10 to 30 atm. The calculated viscosities are expected to be valid throughout the entire range of temperatures and pressures studied. The calculated thermal conductivities are expected to be valid throughout the range of temperatures and pressures except in the vicinity of the critical density. In this region, conductivities will probably be substantially higher. Author (NSA)

**N69-37936*#** National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
**THERMODYNAMIC AND TRANSPORT PROPERTIES OF AIR AND THE COMBUSTION PRODUCTS OF NATURAL**

GAS AND OF ASTM-A-1 FUEL WITH AIR
David J. Poferl, Roger A. Svehla, and Kenneth Lawandowski Washington Oct. 1969 52 p refs
(NASA-TN-D-5452) Avail: CFSTI CSCL 20M

The ratio of specific heats, molecular weight, viscosity, specific heat at constant pressure, thermal conductivity, and Prandtl number were calculated for air, the combustion products of natural gas and air, and the combustion products of ASTM-A-1 jet fuel and air. These properties were calculated for temperatures from 300 to 2500 K, pressures of 3 and 10 atm ($3.04 \times 10^5$ and $10.03 \times 10^5$ $N/m^2$), and fuel-air ratios from zero to stoichiometric. Adiabatic combustion temperatures were also determined. The theoretical data for thermal conductivity and Prandtl number were compared with experimental values of these properties available in the literature. Agreement between the theoretical and experimental data was within 5 percent. Author

N69-38070# Purdue Univ., Lafayette, Ind. Thermophysical Properties Research Center.
A CONTINUING SYSTEMATIC PROGRAM ON TABLES OF THERMOPHYSICAL PROPERTIES OF MATERIALS Summary Technical Report, 1 Jan. – 31 Dec. 1968
C. Y. Ho Wright-Patterson AFB, Ohio AFML Apr. 1969 102 p refs
(Contract F33615-68-C-1229)
(AD-688969; AFML-TR-69-79) Avail: CFSTI CSCL 20/13

This technical report covers work in a continuing systematic program on the thermophysical properties of materials involving the literature search, collection, codification, and organization, and data extraction, compilation, evaluation, correlation, analysis, and synthesis, the preparation of intermediate tables presenting the total available experimental information, and the final preparation of internally consistent tables of best data referred to as Tables of Recommended Most Probable Values. The work reported on consists of data tables projects on the thermal conductivity, specific heat, thermal radiative properties (emittance, reflectance, absorptance, transmittance), thermal diffusivity, and thermal expansion of elements, alloys, compounds, mixtures, and systems, and the thermal conductivity, specific heat, and viscosity of liquids and gases. Property data are presented in both tabular and graphical forms with accompanying tables giving specifications and characterizations of the test specimens. The resulting data tables are disseminated at large through the 13-volume TPRC Series on Thermophysical Properties of Matter, while the resulting bibliographic information is disseminated through the Thermophysical Properties Research Literature Retrieval Guide. This report does not contain the completed thousands of data sheets, but does reproduce in the Appendix the Table of Contents and the Grouping of Materials and List of Figures and Tables for each of the first seven volumes (which contain over 8000 pages) of the TPRC Series to show the scope of their coverage. Author (TAB)

N69-38113# Cambridge Univ. (England). Engineering Dept.
HEAT-TRANSFER CALCULATIONS FOR THE CONSTANT-PROPERTY TURBULENT BOUNDARY LAYER AND COMPARISONS WITH EXPERIMENT
F. A. Dvorak and M. R. Head Aeron. Res. Council 1969 20 p refs Supersedes ARC-29716; See N68-22156
(ARC-R/M-3592; ARC-29716) Copyright. Avail: CFSTI; HMSO $s

A method of calculation proposed earlier depended upon the numerical integration of the heat-transfer equation within fields of velocity and conductivity defined by an approximate solution of the boundary-layer equations. In the present report, some improvements are made to the original calculations and comparisons with experiment are given. The conclusion is reached that, where there are large streamwise variations in surface temperature, only methods essentially similar to the present one are capable of giving acceptably accurate results. Author (ESRO)

N69-38174# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE SOLUTION OF NONLINEAR HEAT CONDUCTION PROBLEMS IN A MEDIUM WITH PHASE TRANSITIONS
F.L. Chernousko [1969] 13 p ref Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 2, 1969 p 6 – 14
Avail: National Translations Center, John Cerar Library, Chicago, Ill. 60616

A new method of solving one dimensional, nonlinear heat conduction problems in a medium with any number of phase transitions is proposed. Isotherms are computed directly and reduced to the Cauchy problem for a system of ordinary differential equations. Numerical examples are also included. Author

N69-38270# California Univ., Livermore. Lawrence Radiation Lab.
THERMO-DYNAMIC EFFECTS INDUCED IN METALS BY A 2 Me-V PULSED ELECTRON BEAM
L. W. Woodruff 8 Apr. 1969 161 p refs Sponsored by AEC
(UCRL-50621) Avail: CFSTI

The absorption of a burst of high energy electrons in metals and the effects were investigated. A pulsed electron beam system was used which emitted electrons with energies up to 2 MeV in a time period of about 50 nsec. Heating the metal targets to a depth of 1 g/cm2 and energy fluxes up to 25 cal/cm2 resulted. The energy profile of the electron beam was mapped radially and axially using aluminum calorimeters, and its energy spectrum was determined. Energy deposition profiles were semiempirically predicted and were corroborated by measurements made with calorimeters. Surface response of irradiated lead and gold targets was made. Peak energy deposition was found to be about 50 cal/g producing pressures of the order of 50 kb (kilobars). Relief of this high pressure resulted in spallation of surface material from the target, producing a corresponding impulse in the remaining target material. Author (NSA)

N69-38271*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMULATION OF PYROLYSIS-GAS FLOW THROUGH A CHAR LAYER DURING ABLATION
Ronald K. Clark Washington Oct. 1969 38 p refs
(NASA-TN-D-5464) Avail: CFSTI CSCL 20M

An experimental study was made to provide some insight into the complex thermochemical phenomena occurring during the flow of pyrolysis gases through an ablator char layer. Resistance-heated porous carbon slabs were used to simulate ablator char layers, and mixtures of methane and helium, simulating pyrolysis gases, were passed through the heated carbon. Tests were made with carbon temperatures up to approximately 3800°R (2100 K) with various mass flow rates, methane concentrations, and carbon thicknesses for two different porosities. Temperatures of the entrance and exit surfaces of the carbon were measured, and gas temperatures and temperature profiles through the carbon were calculated by a simplified analysis. Gas samples were taken at the exit surface of the carbon and analyzed to determine the hydrogen mole fraction which was used as an index to the extent of gas-phase reactions. Postexposure metallographic analyses of the carbon specimens were made to investigate the deposition of carbon in the specimen voids. Principal conclusions from this study are (1) the methane reacts to form hydrogen, solid carbon, and traces of ethylene and acetylene; (2) a transition region of small temperature range exists below which the gas composition is frozen and above which the composition is in chemical equilibrium; (3) the transition region occurs at lower temperatures with greater carbon internal areas; (4) significant amounts of laminer-type carbon, not resulting from gas-phase reactions, were deposited in the specimen voids; and (5) the gas and solid temperatures apparently did not equilibrate until the gases approached the exit surface of the carbon. Author

**N69-38299#** Technidyne, Inc., West Chester, Pa.
**ULTRASONIC COMPACTION OF MARK 279 MOD 0 DELAY IGNITER COMPOSITIONS. Final Report, 1 Apr. 1968 – 1 Feb. 1969**
C. Dana McKinney, Jr. and Richard Pheasant. May 1969. 15 p refs
(Contract N00174-68-C-0442)
(AD-689538; RR-69-23) Avail: CFSTI CSCL 19/1

A feasibility investigation was undertaken to explore the potential in utilizing an ultrasonically activated punch to compact the tungsten delay element compositions being considered for the Mark 279 Mod 0 Delay Igniter. Specifically, it was desired to reduce variance of burn time, and firing test data obtained indicated the probability of achieving this result. It was recommended that investigation be extended to establish an optimum combination of process variables and to produce sufficient data for high-confidence-level statistical determinations. Author (TAB)

**N69-38332#** Aerojet-General Corp., San Ramon, Calif. Nuclear Div.
**THERMODYNAMIC AND TRANSPORT PROPERTIES OF POTASSIUM THERMAL CONDUCTIVITY OF THE VAPOR, VOLUME 1**
P. Y. Achener and J. T. Jouthas. Nov. 1968. 70 p refs
(Contract AT(04-3)-368)
(AGN-8194-Vol-1) Avail: CFSTI

The thermal conductivity of potassium vapor at 892 to 1056°K at pressures from 0.173 to 0.805 atm with superheat ranging from 20 to 65°K is reported. The heat transfer to laminar flow method was used to generate the experimental data. The tests were performed with a specially designed apparatus, fabricated from Nb-1% Zr alloy, which consisted of two boilers, a superheater, a test section (including a thin circular tube in which the measurements were performed), a condenser and a flow measuring device. (For Part 2, see N67-36503.) Author (NSA)

**N69-38359#** Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
**THE INFLUENCE OF ARTIFICIAL ROUGHNESS ON THE INCREASE IN THE CRITICAL HEAT FLUX DENSITY OF WATER IN ANNULAR SPACES UNDER FORCED CONNECTION. PART 1: SUBCOOLED STATE AT THE MEASURING SECTION OUTLET**
E. Burck, W. Hufschmidt, and E. de Clercq. May 1969. 79 p refs Transl. into English from EUR 4040 (German)
(UJB/Trans-197) Avail: AEC Depository Libraries

The critical heat flux density (burnout) of subcooled water in an annular test section with inner heated smooth and rough tubes under forced convection conditions has been measured. The inner tube has been provided with artificial roughnesses of different forms (sandroughness, knurls, threads) and different heights (2.6 $\mu$ to 0.3 mm). It was found that in the tested range of parameters: outlet pressure, Po = 11 to 31 [bar]; mass flow-density, qm = 250 to 3500 [kg/m$^2$s]; and outlet subcooling, $T_s - T_o$ = 0 to 150 [°C], only with the highest roughness (>0.3 mm) could the critical heat flux densities be sensitively increased compared with the smooth surface. This increase of critical heat flux density, however, is relatively small compared with the increase of normal convective heat transfer coefficients without surface boiling on identically roughened surfaces. The measurement of pressure variations in the test section without and with heat supply up to the critical heat flux density is discussed. Author (NSA)

**N69-38383#** Sandia Corp., Albuquerque, N.Mex.
**APOLLO LUNAR RADIOISOTOPIC HEATER Aerothermodynamic Summary Report, Dec. 1968 – Feb. 1969**
Mar. 1969. 56 p refs
(SC-RR-69-125) Avail: CFSTI

Results of the aerodynamic, trajectory, ablation, thermal, and stress analyses completed on the Apollo Lunar Radioisotopic Heater (ALRH) between December 1968 and February 1969 are summarized. Results of the experimental program conducted during the same time period in the Sandia High Enthalpy Arc Tunnel and the NASA/MSC 1.5 megawatt facilities are included. Author (NSA)

**N69-38386#** Argonne National Lab., Ill.
**THERMODYNAMIC PROPERTIES OF GASEOUS Ge SUB 2, GeF SUB 4, GeF SUB 2 AND GeF**
P. A. G. O'Hare. Dec. 1968. 18 p refs
(Contract W-31-109-eng-38)
(ANL-7523) Avail: CFSTI

The thermodynamic functions $(G^0-H^0_0)/T$, $(H^0-H^0_0)/T$, $S^0$, $C^0_p$, $H^0-H^\circ_{298}$, $\Delta Hf$, $\Delta Gf$, and log Kf were calculated and are tabulated for $Ge_2$, $GeF_4$, $GeF_2$, and GeF in the ideal gas state at selected temperatures between 0 and 6000°K. Author (TAB)

**N69-38453#** Argonne National Lab., Ill. Chemical Engineering Div.
**THE THERMODYNAMIC PROPERTIES OF AS 2, AS 4, AND SOME ARSENIC FLUORIDES**
P. A. G. O'Hare. Nov. 1968. 20 p refs
(Contract W-31-109-ENG-38)
(ANL-7568) Avail: CFSTI

The thermodynamic functions $S^0$, $C^0_p$, $H^0-H^0_{298}$, $(H^0-H^0_0)/T$ and $(G^0-H^0_0)/T$ were calculated for gaseous $As_4$, $As_2$, and $AsF_n$ (n = 1, 2, 3, 4, and 5) by the formulas of statistical mechanics. In addition, $\Delta Hf$, $\Delta Gf$, and log Kf values, based on experimental data, are given for $As_4$, $As_2$, $AsF_3$, and $AsF_5$; the corresponding values were estimated for AsF and $AsF_4$. The thermodynamic data were tabulated at 100° intervals between 0° and 2000°K, and also at 273.15° and 298.15°K. Some thermodynamic aspects of the arsenic-fluorine system are discussed briefly. Author (NSA)

**N69-38503#** Sundstrand Aviation-Rockford, Ill.
**ORGANIC WORKING FLUID BOILER INVESTIGATION. AEC ORGANIC RANKINE CYCLE TECHNOLOGY PROGRAM TOPICAL REPORT**
J. L. Martz. 1968. 105 p
(Contract AT(04-3)-651)
(SAN-651-94) Avail: CFSTI

The design of a boiler loop and once through boiler tubes with various boiler tube internal geometries is presented. Heat transfer and stability tests established satisfactory analytical equations for predicting boiler heat transfer performance and established hydrodynamic stability design criteria for once through organic Rankine cycle boiler systems. Test hardware, instrumentation, test procedures, operating difficulties, and test results of a once through Dowtherm-A vaporizer heated by thermal radiation from electrical heaters are discussed. The Dittus-Boelter equation was used in the subcooled single-phase flow region. An original correlation of the form $(Q/A)_b = C\Delta T^n$ was used in the nucleate boiling regime. The Dangler – Addoms correlation was employed to predict film coefficients in the two-phase flow region. Boiler stability tests were also conducted. Inlet throttling of the liquid to the boiler had no apparent effect on stability in any of the tests performed. NSA

**N69-38676#** Du Pont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.
**HYDRODYNAMIC ASPECTS OF THE CRITICAL HEAT FLUX IN SUBCOOLED CONVECTION BOILING**
Eric John Thorgerson (Ph.D. Thesis – South Carolina Univ.) Apr. 1969. 191 p refs
(Contract AT(07-2)-1)
(DPST-69-327) Avail: CFSTI

Two hydrodynamic models of subcooled convection boiling burnout were studied and tested. One model is based on the concept of a critical two-phase boundary thickness at burnout. The other model is based on the boundary layer separation under the

influence of mass injection from the wall as developed by Kutateladze. An experimental program was conducted to determine the effect of hot spots on subcooled flow boiling burnout. The critical heat flux is related to the friction factor through Reynolds analogy between momentum and heat transport. It is also shown that the void fraction in high subcooling, burnout is very low. The boundary layer separation mechanism is found to compare favorably with results in the low subcooling region. The mechanism is extended qualitatively to the higher subcooling region. The boundary layer equation is solved for an annulus, but the results are not conclusive. The experimental program demonstrated that the hot spot burnout heat flux is a function of hot spot position and length, and a strong function of subcooling. Author (NSA)

# 34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

**N69-37399#** Helsinki Univ. (Finland).
**ANNUAL REPORT FOR THE ACADEMIC YEAR 1967–1968**
M. Tiuri 1968 13 p refs
(5-23) Avail: CFSTI

This annual report lists the radio laboratory staff and lecture courses. A bibliography of reports published by staff members and a list of the main topics of research are also given. ESRO

**N69-37681#** RAND Corp., Santa Monica, Calif.
**REDUCING LEAD-TIME THROUGH IMPROVED TECHNOLOGICAL FORECASTING: SOME SPECIFIC SUGGESTIONS FOR MORE USEFULLY FORMULATED PROJECTIONS OF TECHNOLOGICAL AVAILABILITY**
David Novick and Frederick S. Pardee Jun. 1969 17 p Submitted for publication
(AD-689246; P-4122) Avail: CFSTI CSCL 5/1

In new military systems, the development time required must be made as short as possible. In examining this critical problem, perhaps it is useful to first attempt to separate those elements of lead-time of an organizational or administrative nature from those primarily associated with technology. This paper recognizes the importance of administrative lag factors, but focuses its attention on suggestions for more realistically estimating technological lags. Author (TAB)

**N69-37734#** Royal Greenwich Observatory, Herstmonceux (England). Royal Observatory, Cape Town (South Africa).
**TIME AND LATITUDE SERVICE 1967, JANUARY–MARCH**
R. v. d. R. Woolley 1969 18 p Prepared jointly with Roy. Obs. Cape of Good Hope *Its* Bull. No. 148
Copyright. Avail: CFSTI

This bulletin contains the results of the Greenwich Time and Latitude Service for the period 1967 January to March inclusive. Author (ESRO)

**N69-37736#** European Atomic Energy Community, Luxembourg. Center for Information and Documentation.
**MEETING OF EUROPEAN LIBRARIANS WORKING IN THE NUCLEAR FIELD**
Brussels Jun. 1969 119 p refs 5th Ann. Meeting held at Stresa, Italy, 24-25 Apr. 1968
(EUR-4256.e) Avail: CFSTI

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6. CONTACTS BETWEEN THE EURATOM NUCLEAR DOCUMENTATION SYSTEM AND ITS USERS C. Vernimb p 89–116 (See N69-37742 22-34)

**N69-37737#** Zentralstelle fuer Atomkernenergie Documentation, Frankfurt Am Main (West Germany).
**THE INTEGRATED SYSTEM OF THE ISPRA LIBRARY**
W. Rittberger *In* EURATOM Meeting of European Librarians Working in the Nucl. Field Jun. 1969 p 15–38 refs (See N69-37736 22-34)
Avail: CFSTI

A short description of the mechanized and integrated system is given. Bibliographical and bibliotechnical details for the preparation of the data inptu and the lists and catalogs for the integrated procedure are defined and illustrated. Author

**N69-37740#** European Atomic Energy Community, Ispra (Italy). Scientific Information Processing Center.
**THE DEVELOPMENT OF AN AUTOMATIC INDEXING SYSTEM AT EURATOM**
G. Lustig *In its* Meeting of European Librarians Working in the Nucl. Field Jun. 1969 p 61–74 refs (See N69-37736 22-34)
Avail: CFSTI

The Scientific Information Processing Center (CETIS) of EURATOM is developing an automatic indexing system. In view of future applications it aims at maximal compatibility with the manual indexing in the framework of the EURATOM Nuclear Documentation System. An experimental system was realized by means of which a large variety of automatic indexing procedures was tested. The approaches examined, especially the use of statistical relations derived from a collection of abstracts and the corresponding manual keyword assignments, are discussed. The results obtained are presented, and further possibilities of improvement are suggested. Author

**N69-37742#** European Atomic Energy Community, Luxembourg.
**CONTACTS BETWEEN THE EURATOM NUCLEAR DOCUMENTATION SYSTEM AND ITS USERS**
C. Vernimb *In its* Meeting of European Librarians Working in the Nucl. Field Jun. 1969 p 89–116 (See N69-37736 22-34)
Avail: CFSTI

Experience in operating the Euratom Nuclear Documentation System and the statistical evaluation of user comments yielded the following conclusions: (1) Average relevance ratio for documents retrieved by computer in retrospective literature searches is between 35 and 40%. Checking the relevance of the documents before sending them to the user is necessary. (2) Average recall ratio for documents retrieved in retrospective literature searches is about 70%. (3) Average processing time for each query is two weeks. (4) Satisfaction of user with the results is about 90%. (5) Average relevance ratio for documents retrieved in SDI searches is 70%. Checking the relevance of documents before sending them to the user is not necessary due to better query formulation. (6) Average recall ratio for documents retrieved in SDI searches is more than 70%. The average relevance ratio for documents retrieved in retrospective literature searches is expected to increase to more than 80% by a sample screening and relevance feedback method resulting in considerably reduced processing time. Author

N69-37769# Royal Greenwich Observatory, Herstmonceux (England).
**TIME AND LATITUDE SERVICE 1966, JANUARY–MARCH**
R. v. d. R. Woolley 1967 18 p Prepared jointly with Roy. Obs. Cape of Good Hope *Its* Bull. No. 133
Copyright. Avail: CFSTI

This bulletin contains the results of the Greenwich Time and Latitude Service for the period 1966 January to March inclusive. Author (ESRO)

N69-37781# RAND Corp., Santa Monica, Calif.
**ON THE DECISION MATRIX AND THE JUDGMENT PROCESS: A DEVELOPMENTAL DECISION EXAMPLE**
Benjamin Pinkel Jun. 1969 17 p refs
(AD-689797; P-3620) Avail: CFSTI CSCL 5/1

The paper points out that in a decision task involving the selection of a system from a number of competing systems, a single number or figure of merit is usually inadequate to describe the merits of a given system and that a matrix of numbers representing the important parameters is required. A description is given of the parameters in this matrix. Rules are given for reducing the matrix and for drawing conclusions from the reduced matrix. An example involving a developmental decision is included to illustrate the process. Author (TAB)

N69-37800# Rand Corp., Santa Monica, Calif.
**STATIONARY PROPERTIES OF A TWO-ECHLON INVENTORY MODEL FOR LOW DEMAND ITEMS**
R. M. Simon May 1969 43 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-689765; RM-5928-PR) Avail: CFSTI CSCL 15/5

The paper gives a description of a two-echelon inventory model with exact expressions for the stationary distributions of stock-on-hand and backorders at the various facilities. Items are completely recoverable, completely consumable (nonrecoverable), or recoverable with a positive condemnation rate. Repair is performed at base or depot levels, and repair and transportation times are assumed to be deterministic. The model applies to items with reasonably low base demand rates since it is assumed that the bases use continuous review replenishment policies and the depot uses a general policy unless the item is completely recoverable. A solution algorithm enables the construction of a cost-effectiveness curve of inventory investment vs. expected base backorders under an optimal allocation. Because the model yields exact results, it can be used to check other techniques that are developed to treat positive condemnation rates or low demand consumable items. TAB

N69-37807# Southampton Univ. (England).
**INSTITUTE OF SOUND AND VIBRATION RESEARCH Annual Report, Mar. 1969**
1969 138 p refs
Avail: CFSTI

This report describes progress made in the acoustics section (notably in helicopter noise, sound transmission and architectural acoustics work), in the audiology and human factors engineering group and in the fluid dynamics and instrumentation division. The major part of the activities in the industrial noise, vibration and general environmental engineering field has been on vehicle engine noise and vibration, and the major new development in the structural dynamics department during the year has been the work on transient testing methods and on shock isolation. A wide range of community and industrial noise problems have been tackled during the first full year of operation of the industrial noise unit. New developments made available by the random data analysis unit are outlined. ESRO

N69-37887# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
**FACTORS AND UNCERTAINTIES IN THE PROFITABILITY OF USING NUCLEAR ENERGY IN DESALINATION OF WATER [FACTEURS ET INCERTITUDES DE LA RENTABILITE DU RECOURS A L'ENERGIE NUCLEAIRE DANS LE DESSALEMENT DES EAUX]**
Lucien Thiriet and Paul Lievre Jun. 1969 33 p refs In ENGLISH and FRENCH Presented at the Colloq. on the Nucl. Desalination, Madrid, 18–22 Nov. 1968
(CEA-R-3837) Avail: CFSTI

One of the economic advantages of nuclear energy consists of the small proportional element in its cost structure. Economies of scale favor the nuclear station as compared with the conventional thermal one, and when the demand for electricity and heat, in particular for desalination, is sufficient, nuclear energy may, subject to certain conditions, prove advantageous. The object of this paper is to discuss the validity of the conclusions reached according to the hypotheses adopted. In the first part, the different kinds of uncertainties connected with technical, economic and financial data (the various transmission coefficients, the life of equipment according to the choice of materials, changes in prices, the form of price functions and interest rates), and with the various constraints, are examined and discussed. In the second part the uncertainties connected with the method of optimization used and the criterion of selection adopted are examined and discussed. It is shown that it is usually extremely difficult to assume absolutely the competitiveness, or conversely the non-competitiveness, of using nuclear energy in the desalination of water, and that a large number of aspects have to be carefully examined. Author (ESRO)

N69-38016*# Denver Univ., Colo. Industrial Economics Div.
**PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER Quarterly Report, 1 Apr. 1969 – 30 Jun. 1969**
Dean C. Coddington, James E. Freeman, Ronald J. Hensen, H. E. Mew, Jr., R. O. Morgan et al 15 Jul. 1969 137 p refs
(Contract NSR-06-004-063)
(NASA-CR-105967; QR-6) Avail: CFSTI CSCL 05B

This project involves the gathering and analysis of materials to provide a better understanding of the technology transfer process by examining nonspace applications of NASA-developed technology. Research activities are summarized, with emphasis on the operation of the technology transfer data bank, telephone interviews with persons requesting technical support packages, and analyses of the patterns and statistics of requests. A content analysis of 100 specific cases of technology transfers is included in this report. In addition, five frequently requested technical support packages are discussed. K.W.

N69-38078# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
**CONDITIONS OF COMPETITION BETWEEN THE PRODUCTION OF WATER BY DESALINATION AND NATURAL RESOURCES**
Jacques Gaussens Jun. 1969 34 p In ENGLISH and FRENCH Presented at the Colloq. on Nucl. Desalination, Madrid, 18–22 Nov. 1968
(CEA-R-3836) Avail: CFSTI

A close examination of the local supply and demand for fresh water is involved when considering a sea water desalination plant in a given region. This examination makes it possible in most cases to undertake a thorough study of the natural resources, resulting in the use of desalination being rejected. After confirming this fact by precise examples, the author considers that the preliminary study should be extended, taking into account the complementary character of natural resources and desalination systems, i.e. contribution to peak demand, contribution to base demand. This analysis results in a classification of the main user regions according to certain economic criteria defining their suitability for the use of desalination processes. Author (ESRO)

N69-38126# Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).
**REPORTS, NEWS AND BOOK REVIEWS, VOLUME 17,**

**NUMBER 4 [NOTE, RECENSIONI, NOTIZIE, VOLUME 17, NUMERO 4]**
Aug. 1968 148 p refs In ITALIAN; ENGLISH summaries
Avail: CFSTI

CONTENTS:

1. ACTIVE SYNTHESIS OF NETWORK FUNCTIONS WITH SEVERAL VARIABLE PARAMETERS Valerio Cimagalli (Fondazione U. Bordoni) p 613-623 refs (See N69-38127 22-10)

2. DESIGN AND PRACTICAL REALIZATION OF A VARIABLE EQUALIZER BY MEANS OF A MULTIVARIABLE FUNCTION ACTIVE SYNTHESIS METHOD M. Salerno (Fondazione U. Bordoni) p 624-653 refs (See N69-38128 22-10)

3. PERFORMANCES OF PCM TELEPHONE CODES OPERATING BOTH IN MIDRISER AND MIDSTEP CONDITIONS Maurizio Decina and Luigi Giacomelli (Fondazione U. Bordoni) p 654-684 refs (See N69-38129 22-09)

4. DELAY LINE IN PAL DECODERS. THEORETICAL CONSIDERATIONS AND EXPERIMENTAL RESULTS G. Morgantids (Fondazione U. Bordoni) and L. Bencini p 685-695 (See N69-38130 22-03)

**N69-38149#** National Transportation Safety Board, Washington, D.C.
**NATIONAL TRANSPORTATION SAFETY BOARD Annual Report to Congress, 1968**
8 Jul. 1969 60 p refs
Avail: Issuing Activity

The activities of the National Transportation Safety Board are submitted for the calendar year, 1968. Efforts toward identification and definition of the problems related to the causes of accidents are described for the total transportation system which includes marine, railroad, highway, pipeline, and civil aviation safety. Legislative recommendations were made during this period to the Congress in each of these areas. Highlights of the Board's year include the initiation of 896 on-the-scene aviation accidents, six public hearings about aircraft accidents, investigations of a collapsed bridge in West Virginia, many maritime accidents, airman appeals, school bus grade-crossing accidents, and numerous recommendations to the Department of Transportation for improved surface safety. These cases and aviation accident statistics for the past 10 years are presented in detail. M.H.E.

**N69-38314#** Naval Research Lab., Washington, D.C.
**[NAVAL RESEARCH LABORATORY] Progress Report**
Aug. 1969 30 p refs
(NAVSO-P-30/2) Avail: CFSTI

Summaries of the following work are presented: (1) in physics: two studies on sound propagation, scattering, and sonar measurements in water; an atmospheric study of spectral radiance of the horizon sky; a computer program to analyze optical parametric up-conversion processes in nonlinear crystals; and interaction of phonons with highly polarizable nonharmonic impurities; (2) in metallurgy: dislocation and orientation of aluminum oxide single crystals; microstructure of the metal-oxide interface in FeO-Fe; the 550°F radiation embrittlement of A 533-B class 1 electroslag weldment; and comparison of calculated plastic zone size and fracture toughness of three metals; (3) in chemistry: corrosion resistance of common construction metals to a light water fire-extinguishing agent; and the role of water vapor on the $LiOH\text{-}CO_2$ reaction in a dynamic system; (4) two radar sea surveillance studies, one involving Doppler spectra, the other nanosecond radar; (5) two studies of mechanical properties of metals and ceramics used in ship construction; (6) use of the voltage level as a parameter in aircraft dc electrical systems; and (7) two mathematical projects, one in digital diagnostic techniques, the other on the use of universal logic blocks in network analysis. In two separate articles, the diffracting properties of LiF are compared with those of graphite, and the design of a constant ambient temperature chamber is described. K.W.

N68-37699 Royal Greenwich Observatory, Hailsham (England)
TIME AND LATITUDE SERVICE 1968 JANUARY - MARCH
R. v. d. R. Woolley 1967 16 p Prepared jointly with Roy. Obs. Cape of Good Hope (R-Obs-No-133)
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This bulletin contains the results of the Greenwich Time and Latitude Service for the period 1968 January to March inclusive.
Author (ESRO)

N68-37701# RAND Corp., Santa Monica, Calif.
ON THE DECISION MATRIX AND THE JUDGMENT PROCESS: A DEVELOPMENTAL DECISION EXAMPLE
Benjamin Pinkel Jan 1968 17 p refs
(AD-669797; P-3820) Avail: CFSTI CSCL 5/9

The paper points out that in a decision task involving the election of a system from a number of competing systems a single number or figure of merit is usually inadequate to describe the merits of a given system and that a matrix of numbers representing the important characteristics is required. A description is given of six parameters in this matrix. Rules are given for reducing the matrix and for drawing conclusions from the reduced matrix. An example involving a developmental decision is included to illustrate the process.
Author (TAB)

N68-37806# RAND Corp., Santa Monica, Calif.
STATIONARY PROPERTIES OF A TWO-ECHELON INVENTORY MODEL FOR LOW DEMAND ITEMS
A. M. Gleser May 1968 43 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-669765; RM-5923-PR) Avail: CFSTI CSCL 15/5

The paper gives a description of a multiechelon inventory model with exact expressions for the stationary distributions of stock on hand and backorders at the various facilities. Items are considered repairable, consumable (nonrepairable), or repairable with a positive condemnation rate. Repair is performed at base or depot levels, and repair and transportation times are assumed to be compounded Poisson processes. The model applies to items with reasonably low base demand rates since it is assumed that the base use continuous review ordering and policies and the depot uses a periodic policy unless the item is completely nonrepairable. A solution algorithm enables the construction of a cost-effectiveness curve of inventory investment vs expected peacetime backorders under an optimal allocation. Because the model yields exact results, it can be used to check other techniques that are developed to treat pipeline compensation rates at low demand compatible items.
TAB

N68-37807# Southampton Univ. (England)
INSTITUTE OF SOUND AND VIBRATION RESEARCH Annual Report, Mar. 1968
1968 126 p refs
Avail: CFSTI

This report describes progress made in the research project carried on helicopter noise, sound transmission and architectural acoustics, work in the underlying and human factors engineering areas, and in the fluid dynamics and aeromechanics groups. The major part of the activities in the industrial noise, vibration and control, environmental engineering field was based on vehicle engine noise and vibration, and the major new developments in the structural dynamics department during the year has been the work on impulse testing methods and on shock isolation. A wide range of community and industrial noise problems have been tackled during the first full year of operation of the industrial noise unit. Very few developments made available by the previous year's work are outlined.
ESRO

N68-37903# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires
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